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THE ELECTRICAL TRADES UNION.

THE time has arrived when the *employés* of the various branches of the electrical trades feel the necessity for banding themselves together for the protection and maintenance of their particular trade interests. We may say that the "union" is already a *fait accompli*, and it remains, therefore, only to consider, not the desirability or otherwise of having such a combination, but how to handle it on the best lines possible. There can be no doubt that the employed often obtain many advantages from such an institution; it may, and should be, not only a combination for the purpose of regulating wages, but for the mutual aid and support of the members in their relations to one another. Taking, for example, one of the most important trade organisations, we find, there, among the advantages to be obtained by members:—1. Out of work pay; 2. Superannuation allowance; 3. Removal allowance, in case of work being obtainable in the provinces; 4. Emigration allowance; 5. A "house of call;" 6. The use of a reading room, library, &c.; 7. A funeral allowance, a portion of which may be available on decease of a wife.

It will thus be seen that a properly-constituted society combines many useful features: it is an insurance society as well as a wage regulator; it is to some extent a club, and also a place where work may be obtained; it aids the living, and helps to pay for the decent interment of the dead.

There is, perhaps, one disagreeable result of a trade society such as that sketched above, for where the wages are uniform the tendency will always be for the employer to take the best man available, and the weaker must consequently tend to "go to the wall;" but where the wage is according to the skill of the *employé*, it is not necessarily so, as an inferior hand (whether his inferiority results from mental or physical weakness matters not) may get work at less wages than his stronger *confrère*; yet he still gets work.

The employers, too, have *some* advantages in dealing with the members of a trade society: (1) In furnishing estimates and in the making of contracts they have a fixed scale to rely upon; (2) They have the "house of call" from which to obtain hands; (3) They have a recognised body to deal with, in the elected committee of the society.

In the Electrical Trades Society we hope that the committee will collect the "rules and regulations" of other bodies, and then base their own on the best of them; a good start in this respect is of immense importance to its future; it is even of more importance than the mere enrolment of names, for on a well secured base the rest will be sure to follow.

There can be but little doubt that, although unity of the electrical trades throughout the country is desirable, it will probably be found that branch societies in important districts, affiliated to the London organisation, will be found the more workable method of dealing with the matter. Rates of living and other conditions may prevent the same regulations being desirable, or even applicable to provincial towns, and to London alike.

The movement seems strongly supported, and we trust that it will be guided wisely and well to the benefit and prosperity of the whole industry.

HIGH TENSION—DEATH CURRENTS.

WHATEVER doubt we, in England, may have as to the precise meaning intended to be conveyed to his hearers by Mr. Preece in his endeavour to minimise the danger likely to be incurred from high-tension currents, in America his words have been taken literally, and the independent Press on that side has not been backward in taking him to task. Listen to what one of the daily papers prints on the occasion of another fatal accident from an electric lighting current of high potential:—

"How small must Mr. Preece, the English electrician, feel! He, the great scientist, could not kill a pig with a high voltage current, and we in this city (New York) kill three persons in a month by currents passing through insulated wires. Or was Mr. Preece not aware that the pig is by nature enveloped with an insulating material, *i.e.*, 'fat,' and so can not only afford to withstand Mr. Preece's high voltage currents of feeble electrical energy, but also the highly dangerous Westinghouse alternating currents which are used in this city and have to serve electrocution purposes. Henceforth the pig should be made the symbol for electrical insulation. But man, the highest animal in creation, has to fight the elements and Nature's forces uncovered and unprotected." Horror upon horror! the sins of the high voltage combination, their coadjutors and abettors, are visited upon the innocent. The misrepresentations of the electricians employed in the high voltage interest have proven to be falsehoods purposely made."

On the other hand, Mr. Preece's remarks have been turned to good advertising use to prove, on the authority of so experienced an electrician whose reputation is world-wide, the comparatively harmless nature of what we all must know to be currents whose employment is fraught with so much danger, that at any moment, and in the most unexpected manner, a human life may be sacrificed; and under the particular circumstances attendant on the use of these dangerous currents in the United States, it is well put by a contemporary, "Another victim offered up at the shrine of greed." The unfortunate misconstruction that it has been possible to put upon Mr. Preece's words only emphasises once more how essential it is to weigh every sentence before it is uttered, and to express one's self in such language that no other interpretation can be given to his words but that which the speaker intended.

During the week ending October the 11th two fatalities occurred in New York, both victims being linesmen who were struck down whilst performing their ordinary duty. One of these cases was accompanied with such horrible details, and took place in full daylight in the presence of a large crowd, that a kind of panic has struck the people, and terror reigns supreme. The public press has taken the matter up, and is asking, how long will this indiscriminate slaughter be suffered to go on? How long will the companies with systems working at high pressure be allowed to evade the law? It is not improbable, therefore, that popular clamour may compel the various electric light companies to put their plant in order, and to carry on their business with some regard for the lives both of the public and their own *employés*.

A CORRESPONDENCE has recently been carried on in the *Globe* on that never-failing subject, the cost of Letters patent. The general consensus of opinion is, as it always has been, that the fees demanded are very much too high, and that £10 ought to cover the whole period during which a patent can last. The usual argument is brought forward, viz., that invention is stifled by excessive fees, and it is further assumed that if the excessive cost were brought down to the figure named, not only would the Patent Office not suffer in its income, but invention would be enormously stimulated, so that our American cousins would no longer have the race all to themselves as they are stated to have at present. We imagine that people who argue in this manner do not entirely understand the conditions which have so stimulated invention in America. Have the recent changes in the English patent law advanced useful invention to any appreciable extent? Of course the number of patents taken out has greatly increased, but has the total number of those which have proved useful and brought hard cash into the pockets of the inventors increased to a like extent? We doubt it. Desirable as it may seem to assimilate the English to the American system, we certainly think we require considerably more sound and logical evidence than we at present possess to prove that as much wide-spread benefit would result from such an assimilation, as is imagined by many.

IN the early days of telegraphy, when the wires were placed underground in pipes, and upright test boxes were used for connecting the cables together, it was not an unusual thing for an explosion of gas to occur, when a light was accidentally allowed to approach too near one of these boxes or posts, as they formed not only receptacles for the joints, &c., but also for the gas which escaped from the mains. Explosions in the streets of London from underground telegraph pipes have practically ceased, due to the facts that the gas companies are more particular as to the manner in which their mains and connections are made, and that the telegraph pipes are also jointed in a very careful manner; so, on the one hand, there is less escape of gas, and on the other, a greater difficulty in the leakage finding its way into the telegraph pipes and the joint boxes; these latter being usually "flush," or below the surface, do not offer the same opportunity for the gas to accumulate as the old vertical boxes.

BUT the gas does still escape from the company's mains and connections, as any opening in our streets makes one painfully aware, and it appears to us that with the large sized conduits now being laid down for electric light conductors, there is a possibility of a renewal of the subway explosions formerly prevalant in London, and now so frequently happening in New York and other American cities, unless some preventive means are adopted by those companies now laying down open conduits. The matter is looked upon in the United States as a special field for the inventor, for the technical journals are weekly recording the patents which are being applied for for cleansing the conduits, and keeping them free from gas. It is not too much to say that the advent of gas into our street electric conduits is extremely probable, if not absolutely certain; have our electric light companies thought of it?

IT is, however, of no very great avail to puzzle one's brains over "air-propellers" and other forces to cleanse the conduits, whilst very simple and practical methods will accomplish all that is desired. We give here an extract from the annual report of the Brooklyn Telephone Company, recently published, which, under the circumstances we have pointed out, will be found of some practical interest:—"The practice of ventilating the conduits and manholes, as they are constructed, by lateral branches to poles and housetops, and to which we ascribe our freedom from explosions, has been extended considerably during the past year by placing three-inch iron pipes from manholes to the columns of the elevated railroad, which serve the double purpose of ducts and ventilators. The quantity of gas in conduits and manholes has been sensibly reduced, and, in two instances, where conduits entered central office basement, the odour of gas, which it seemed impossible to entirely exclude, disappeared entirely after the manholes outside were connected to the elevated railroad structure by a number of three-inch iron pipes. A large tube, leading to a dead chimney at the Brooklyn office, in connection with pipes to elevated railroad near by, usually keeps the large tunnel through which the conduits enter the building pretty free from gas. We believe ventilation of this kind is the easiest and best method of preventing the explosions in manholes occasionally reported from other cities." With this conclusion we quite concur.

THE important action taken with regard to the Edinburgh Exhibition by Major Flood Page at the meeting on Monday last of the Electrical Trades Section of the London Chamber of Commerce we hail with satisfaction. Exhibitions are deserving enough of support under certain conditions, and serve to demonstrate to the public what can be achieved—in fact, are, from the trades point of view, good advertisements where it is the eye of the public which it is intended to catch. These advertisements may, however, be purchased too dearly, and when such a time arrives, as it appears to have done now, it is desirable that the electrical trades should consider well the costs and advantages to be derived, and when a decision is arrived at that the industry generally should either give as far as possible its support or withhold it. From the original International Exhibition of former days to the present so-called International Exhibitions there is a wide difference; then, they were destined to inform the whole world, now mainly, to inform a neighbourhood and to make money locally. We have no doubt that the committee appointed by the section of the Chamber of Commerce will be able to arrive at a wise decision in the interests of the electrical trades, and have genuine pleasure in seeing so important a question obtaining the chance of a proper settlement. Our own opinion is that the electrical trades have little to gain at this time by exhibiting, while the Exhibition will lose much by their not doing so.

THE electric light has been adopted with success by the Cheshire Lines Committee; particulars as to the system employed will be found in our "Notes" columns. A good light in a railway carriage is a great luxury, and it seems strange the lighting of trains generally is so far behind the times. This was painfully obvious when returning from the recent British Association meetings at Newcastle by the Great Northern Railway. The entire compartment was lighted by a feeble smoky oil lamp, rendering reading impossible. We trust our great railway companies will soon see the necessity of adopting the electric light, or at any rate a much better light than is at present in use.

IT might have been thought that in this year of grace, 1889, the electric light engineer would have known by name the quantities with which he deals; but apparently this is quite an unwarrantable assumption, the tendency seeming to be towards the invention of new terms, rather than towards the better comprehension of old ones. Referring to an article in an electrical contemporary of last week, we learn that the London Electric Supply Corporation was to charge by meter for the City lighting at 3s. 6d. *per unit of 10,000 watts*, and it is implied, in parenthesis, that a Board of Trade unit is 1,000 watts, which, of course, it is not. In the same article we are told that the Metropolitan Electric Supply Company was to charge 6s. 8d. *per unit of 10,000 ampères*, which is declared to be equal to 8d. per Board of Trade unit. From another paragraph we learn that the Anglo-American Brush Corporation was to charge 8d. *per unit of 1,000 watts*. The italics are our own.

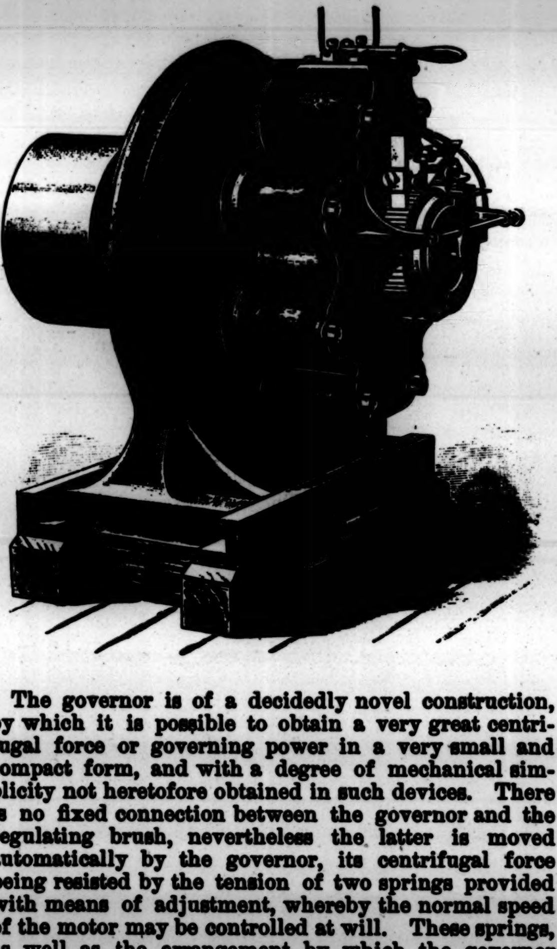
WE presume that in the case of the Metropolitan Company the printer's devil has transformed watts into ampères, but either is equally incorrect, for it so happens that we measure work neither by watts nor ampères, the former merely telling us the rate at which work is being done in joules per second, and the latter the rate of current flow in coulombs per second. It is somewhat remarkable to find such glaring errors published in a technical journal without comment, but unfortunately it is by no means uncommon. In the very last number of the *Electrical Engineer*, of New York, we find the International Electrical Congress reported as having adopted the joule as the practical unit of work, "*being the energy generated by an ampère through an ohm.*" Surely it is time that these units were thoroughly understood. The contemporary first alluded to asks, in a leading article, why this question of lighting the City is again referred back. We suggest that it is in order that electricians may have a little more time to master their units.

WE are glad to see that the Chamber of Commerce has under consideration the question of a uniform standard for small metal screws, and that the British Association standard screw threads are likely to be brought more prominently forward. We have on previous occasions drawn attention to the want of a recognised standard, and from the remarks made at the meeting of the Chamber last Monday by Mr. A. Le Neve Foster, of Messrs. Davis and Timmins, Limited, it would appear that the B.A. screw thread is being used to a larger extent and becoming more general than many people are perhaps aware. Messrs. Davis and Timmins should be authorities in this matter, for besides being the largest manufacturers of this class of work, and they have now for some time past taken up the B.A. standard, stocking a large assortment of these screws, and must therefore be in a position to form a very correct estimate of the rapid manner in which this standard is being introduced. It is somewhat astonishing that some of our principal electrical instrument makers still adhere to their old threads, only departing from them to a standard size when executing contracts for the Postal Telegraphs. Probably this question of gauge is considered by manufacturers as a minor detail, to be left in the hands of a foreman, and workshop ideas are often very conservative.

A NEW BAXTER MOTOR.

WE illustrate on this page a new motor that has recently been designed by Mr. W. Baxter, of Baltimore, in which, according to the *Electrical World*, the inventor adopts a novel form and dispenses with exterior regulating devices.

In the new motor, as will be noticed, there are three brushes on the commutator, all of which are located on the upper side. The regulation is effected by moving the last brush automatically by the governor. The movement of this brush maintains the speed constant by varying the counter electromotive force of the armature. The regulation is very close, owing to the fact that a movement of the brush of less than one-fourth of an inch will vary the counter E.M.F., or what is the same thing, the mechanical output, from zero up to the full capacity of the motor.



The governor is of a decidedly novel construction, by which it is possible to obtain a very great centrifugal force or governing power in a very small and compact form, and with a degree of mechanical simplicity not heretofore obtained in such devices. There is no fixed connection between the governor and the regulating brush, nevertheless the latter is moved automatically by the governor, its centrifugal force being resisted by the tension of two springs provided with means of adjustment, whereby the normal speed of the motor may be controlled at will. These springs, as well as the arrangement by which the governor controls the movement of the regulating brush, are not shown, as they are located partly inside the commutator and partly back of it.

The regulating brush is carried on a very light frame, which swings in almost frictionless trunnions. It therefore requires a very small effort to move it, and, as the governor is of such a design as to be very compact, it can be made small enough to be located inside the commutator, where it is not only entirely out of the way, but is thoroughly protected from accidental injury.

One of the advantages of this motor, in addition to those already enumerated, is that it will reverse the direction of its torque if the speed is increased very slightly above the normal velocity, and with a still further increase, the negative torque will rise very fast. The effect of this on the regulator is to prevent racing. If the belt runs off and the armature begins to accelerate its motion, the governor at once moves the regulating brush up to and, if necessary, back from the zero point. By this movement the torque becomes zero and, if necessary, negative, and tends to bring the motor to a standstill.

The governor is so proportioned that a variation of about 2 per cent. in the velocity from the normal speed will cause it to move the regulating brush from the point of maximum to the point of minimum output, and a further increase in speed of 2 per cent. will move it beyond the zero line a distance equal to that at which it stands in front when doing the maximum work. Therefore, an increase in speed of 4 per cent. will cause the armature to resist rotation with a force as great as its maximum torque. Under such conditions it is evident that racing is not possible, as the action is equivalent to applying a brake to the pulley with the full power of the motor.

One of the fundamental principles of close regulation with centrifugal governors is that all the moving parts, except the governor weights or balls, shall be as light as possible, so that their inertia may be reduced to a minimum, and thus avoid the use of an unnecessarily large governor, and consequently large expenditure of power for the purpose of effecting the regulation. This principle is thoroughly carried out in the motor. The moving parts of the governing mechanism are not only as light as it is possible to make them, consistent with the requisite strength, but the distance through which they have to move is exceedingly small; thus in a 10 horse-power motor the total movement of the regulating brush to vary the load from zero to the full capacity of the machine is less than one-fourth of an inch.

The property of this motor, whereby it reverses its torque when the speed rises above the normal very slightly, is of very great importance in motors used to run spur-gear elevator machines. Motors regulated by cutting out the field cannot be used for this purpose unless specially wound. Mr. Baxter patented a method of winding to adapt his old motor to this class of work, but the regular wound or standard machine, although wound partly in this way, will not give a negative torque of sufficient force to hold back a spur-gear elevator when the car descends with a heavy load, as the reverse torque is only enough to insure close regulation and prevent racing.

To understand the necessity of making a motor that will hold back with a force nearly as great as its maximum capacity, in order that it may operate a spur-gear elevator successfully, it must be borne in mind that when the elevator descends with a full load it requires about two-thirds as much effort to hold it back as it does to raise the same load, and, therefore, unless the descent is resisted by a force nearly equal to this, the velocity of the car would become very great, while the armature would attain such a high velocity as to throw itself to pieces.

The advantages of having a motor of such a character that it will operate perfectly under all the various conditions to which it may be subjected without having to be specially constructed to be adapted to particular cases, is certainly very great and so self-evident as to require no further elucidation.

Mr. Baxter has for a long time believed that by arranging the magnetic field in a certain way, and using a particular method of commutation, the output of a machine could be very greatly increased. As a consequence of this belief he has been working hard for some time past making investigations in the principles of these machines in a new and almost unexplored field. These investigations have resulted in convincing him of the correctness of his conclusions, that by designing electrical machinery in accordance with certain principles, a very great reduction can be made in the weight of the machine as well as in the velocity.

The reduction in weight in most cases is principally a benefit to the manufacturer, but a reduction in the speed is a decided benefit to the machine. It not only reduces the amount of counter-shafting required to transmit the motion but reduces the liability to get out of order and prolongs the life of the motor.

It is well known by those who have had experience in the management of electric machinery, that most of the "diseases of the dynamo" are due to high speed. It is high speed that causes the journals to heat and cut. It is high speed that makes the brushes dance and flash on the commutator, and this flashing, besides burning up and cutting the brushes and commutator, often short-circuits the sections, and in this way destroys the armature coils.

In the new Baxter motor the speed is very low. The 10 H.P. motor runs at a velocity of only 600 revolutions per minute. Notwithstanding this great reduction in speed, the weight is only 800 pounds. The dimensions are:—22 inches wide, 28 inches long, and 25 inches high; the total weight, 83 lbs. The internal resistance of a 10-ampère motor is 3¼ ohms, therefore the energy absorbed by the internal resistance is $3\frac{1}{4} \times 10^2 = 325$ watts, which is less than 4½ per cent. of the total energy of the machine. The frictional loss in this machine is very small, owing to the low speed. The commercial efficiency is between 91 and 92 per cent.

If the new motor were run at the ordinary speed of 1,800 revolutions per minute it would give 30 horse-power, which would be an output at the rate of 1 horse-power for about every 27 pounds of machine. At the actual running speed the output is 1 horse-power for every 80 pounds of weight in the machine.

Mr. Baxter has applied the same principles of construction to electric generators, and in the large sizes gets an output of 1 horse-power for every 25 pounds of machine, and at the very low velocity of 500 revolutions per minute. By a slight modification of the same principles he has succeeded in designing a motor for street car propulsion which, he informs us, gives such an enormous torque that it can be applied directly to the car-wheel axle.

This motor not only does away with all the gearing and its connections now used, but reduces the weight of the electrical part of the car about 60 per cent.

The mechanical features of the new motor are excellent. The shaft runs in bearings that are held by one and the same casting, therefore they cannot get out of line by the loosening of a bolt or in any other way. The armature is held by a brass spider attached to the shaft, and is so secured that it cannot possibly shift or get out of balance. There is a shield that covers the armature so as to protect it from accidental injury. This shield also serves as a support for all the brush-holders, the governor connections, and the starting switch. The design is artistic and symmetrical, and while an abundance of room is given to every part, the outside dimensions are small.

ELECTRICITY IN GYNÆCOLOGY.*

By J. E. BURTON, M.A., L.R.C.P.Lond., M.R.C.S.Eng., Surgeon to the Hospital for Women, Liverpool.

LONG before the time of Apostoli electricity in one or more of its forms was used in gynæcology, and nearly all who used it in former times, empirically, without a definite aim, and without dosage, in the vain hope that it would "do something," were disappointed. This was not to be wondered at. It was something like trying a new medicine, when they knew neither its action nor its strength. It is due to Dr. Apostoli, of Paris, to acknowledge that he has furbished up an old and castaway weapon; he has instructed us to the mode of its intelligent and safe employment, and we, or at least many of us, find that it was just the very thing needed to bring about certain results that we knew could be brought about in some cases, and what nature herself sometimes accomplished without the aid of art, *i.e.*, the reduction of uterine fibromata. It is not so many years ago that I heard a distinguished professor of gynæcology speaking very deprecatingly of any attempts to treat fibroid tumours of the uterus. Such cases were sent to him not unfrequently, he said, accompanied by the request that he should do something to relieve them. Practitioners had some strange ideas, he went on, to imagine that he should interfere with such growths. They little knew the danger that would be encountered. Omitting to speak of Hildebrand's treatment by interstitial injections of ergotine, and which had a certain amount of success, and of Byford's, by the long-continued administration of ergot by the mouth, and which he claims to have been very successful, we come to the next stage of castration or removal of the ovaries. This has been undoubtedly successful in a large proportion of cases. In some patients the operation is exceedingly easy and simple, in others it is well nigh impossible, and the doubt as to the practicability of the operation before the abdomen is opened, constitutes a material drawback. It has to be borne in mind, also, that the operation renders the patient operated on a female eunuch. But the operation is not always successful. In some of the very worst cases, those of submucous fibroids, that are attended often with frightful hæmorrhage, the operation fails completely. It may neither arrest the bleeding nor the growth of the tumour; in other words, the operation is unreliable as well as occasionlly extremely difficult, if not impossible of performance, and in even the most accomplished hands it is to some extent dangerous to life. The operation of hysterectomy, again, is notoriously dangerous to life, and no gynæcologist would lightly counsel his unfortunate patient to submit to its risks. It must be confessed, however, that there is a brilliancy about operative treatment that is very attractive to the surgeon. To do something bold, that shall at a stroke, as it were, free his patient from all her troubles, and put her in a state of health and capacity to enjoy life, has a fascination about it that it requires some strength of mind to resist. The consciousness of strength possessed by some surgeons, of the ability within them to carry a patient through a dangerous crisis, is a something that renders them at least not averse from making an essay, when there are reasonable grounds for anticipating success. Probably it is this feeling that is to some extent responsible for the hostile spirit with which the electrical treatment of uterine tumours has been met. The treatment is slow, not heroic, has nothing brilliant about it (but the result), and the surgeon who employs it misses an opportunity of playing for applause; in fact, he puts all such opportunities from him by the selection of electrical treatment. Another hindrance to its rapid general introduction into gynæcology is the fact that it was not introduced by a recognised gynæcologist. Dr. Apostoli is more of an electrician than a gynæcologist, or, it would be better to say, he was an electrician first and a gynæcologist afterwards. But a moment's consideration will show that the treatment introduced by him could not have been introduced by a mere gynæcologist. It requires a more intimate acquaintance with electricity than any gynæcologist who is a gynæcologist only is likely to possess. If he, as an accomplished electrician, has shown us how to apply electricity to gynæcology, we ought to be thankful, or, if gratitude is not in our nature, we might at least, like shrewd practical men, take a hint when we have an opportunity.

Now, what are the facts? The electrical treatment of uterine fibroids, as introduced by Dr. Apostoli, will certainly reduce them to insignificance, if it will not entirely remove them. Along with the reduction in size which it effects, it checks hæmorrhages and relieves pain, so that with some trouble and perseverance on the part of the attendant and patience on that of the patient she is placed in as good a condition practically as if the tumour were removed, and this without lying up, with little pain and but little danger to life. There is sufficient evidence of this now before us as to place it beyond doubt. Dr. Thomas Keith, by far the most successful hysterectomist we possess, is so well satisfied with the electrical treatment that he states that since he began to use it he has never seen a case on which he had found it necessary to perform hysterectomy; that it is no longer a question of importance as to the best way of performing hysterectomy or treating the stump, as since the introduction of Apostoli's method the operation with its risks is no longer called for. Prof. Simpson, of Edinburgh, who is employing it, is also, I am informed, getting excellent results. Dr. A. S. Playfair is also using it extensively, and is quite satisfied of its capabilities. I have been using it steadily for a year and a half, and with almost invariable success. During this period I have treated over 20 cases of uterine fibroma or myoma. In most of them the tumour has diminished very much in size, and symptoms have been relieved—*i.e.*, the patients have been symptomatically cured. In one, at least, whom I examined recently no trace of tumour could be discovered, although when she began treatment on January 18th, 1888, it was the size of a small cocoa-nut, and reached to within an inch of the umbilicus. This patient has had no treatment since June, 1888, so that it is one instance in which the disease has not returned. In another case kindly placed under my care for electrical treatment by Dr. Briggs this year, which has had at least 25 applications, there is no improvement so far. The tumour is, I think, larger, and the pain and hæmorrhage are no better. The subject has been up for public discussion on several occasions. The chief thing remarkable about these discussions has been the fact that those who have given electrical treatment a fair trial have been, on the whole, pleased with it, whilst those who have not done so have with remarkable unanimity condemned it, or pooh-poohed it, and called the battery a toy.

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* *The Medical Press and Circular.*

Although Apostoli has reported no death during the course of treatment by high currents, several of his cases are reported in his writings to have passed through more or less severe inflammatory crises. This has been a point touched upon at the societies, and several cases of septicæmia are reported to have occurred, from which, however, the patients ultimately recovered, after passing through a condition that threatened to prove fatal. This fortunate termination of a grave disease is not always to be expected, as, if the septicæma is subsiding, some intercurrent mischief may weigh down the balance on the unfavourable side. This occurred in a case under treatment by me. A lady suffering from a myoma that gave rise to profuse hæmorrhage had been under the Apostoli treatment several weeks. She bore the current remarkably well, and strengths of 250 and even 300 milliampères were not in the least complained of. I should say, parenthetically, that the battery used is a Gaiffe's sulphate of mercury battery of 24 cells, and that the galvanometer is his horizontal one, of which the resistance is known, and which approximates towards accuracy within 2 per cent. As part of the tumour occupied the posterior wall of the cervix, and the canal of this part was in consequence flattened out and stretched, the platinum electrode used could only touch a small portion of the surface at one time, and although the tumour was manifestly reduced in size I could not say that the hæmorrhage was much, if any, better. The reason of this is evident now, but was not by any means so at the time. In order to get more effect I applied the point of the electrode to the mucous membrane just within the cervix, but did not penetrate through it, and the last time I did it was June 5th, 1888. On June 9th I was asked to see her, and found some abdominal tenderness and high temperature. I saw her almost daily after this to the 15th, when the symptoms so far subsided that I went out of town till the 18th. On the evening of the 18th I saw her; the temperature was high, 105·6°, and the pulse rapid. There was an offensive vaginal discharge, and a slough could be felt near the seat of puncture. By careful attention everything soon became sweet, and the slough came away. This condition continued till June 26th, when the temperature became practically normal. Shortly after, however, coma, which resembled that of uræmia, and which was declared by Dr. Carter to be uræmia, came on, and the patient died on July 3rd, exactly four weeks after the last application. In this case, as in those reported to the societies, the septicæmia subsided, but after this there was another enemy to contend with, and this proved too much.

In another case, in which 17 applications of various strengths have been given, I confess I do not find much improvement,[*] and this introduces the question, is Apostoli's method as perfect as it can be made? or is it capable of improvement? It would be very singular if a new method of treatment sprang into existence perfect at all points. It would be quite different from anything with which we have been hitherto acquainted, different, for instance, from the operations of lithotomy, ovariotomy, hysterectomy, or any other "tomy." It is quite possible then that cases that resist cure on the method now general, will yield when more perfect appliances and methods are employed. Dr. Apostoli himself has in fact anticipated this question, and furnished an answer to it. At the meeting of the British Medical Association at Glasgow last year he discussed some of the imperfections of his method, and suggested a remedy for them. The question of intensity has to be calculated, at least it is well that it should be, as things otherwise unintelligible will thereby become plain. We will suppose, for instance, that to produce a certain effect a current of 250 milliampères is necessary, and that the ordinary platinum sound is being used. Gaiffe's platinum sound has an area, roughly speaking, of 675 millimetres, and 200 milliampères given off from an area of 657 millimetres give 1 milliampère to every 3·375 square millimetres of surface. But if you have an electrode twice the length of this, and the current is given off from the whole of it, you have an intensity of only one-half, or 1 milliampère to every 7·50 square millimetres, and possibly altogether too weak to do the work required. To remedy this defect Dr. Apostoli has had electrodes of carbon constructed, by means of which the dosage can be accurately ascertained; the area of each being known, the intensity is a matter of easy calculation. These electrodes are all 25 millimetres in length, and vary in diameter from 5 to 11 millimetres. An electrode, 9 millimetres in diameter and 25 long, has an area practically equal to that of his platinum sound as far as the notch, and the dosage must of course be increased or diminished just as a larger or smaller electrode is made use of. Where irregularities of surface on the interior of the uterus are numerous, he employs a preparation called gelosine, which is a good conductor, and which is at the same time so soft that it can be moulded to all the irregularities of surface. By one or other of these means, the graduated carbon electrodes, or the gelosine, the caustic action can be applied with certainty and precision to every part of the uterine cavity, so that the whole of the mucous membrane is acted on alike. It is expected that by means of the new and improved electrodes cases will be cured more quickly, and that such rare cases as have, up to the present, proved refractory, will be brought within the general rule, and gradually melt away.

There is still no definite opinion regarding the *modus operandi* of electricity in tumour cases. Some talk of the electrolysis of tumours, whilst others deny that any great electrolytic action can be produced, and as they know of no other mode of action, they deny that any can take place at all, just as it was proved indisputably in Liverpool many years ago that steamers could not cross the Atlantic. Said the objectors—and it was then difficult to deny any of the premisses—If you have fine weather and the sea continues smooth, well and good, but if the sea happens to get the least bit rough, it will present an uneven irregular surface. The moment this takes place one paddle wheel will sink lower down in the water than its fellow. As soon as it sinks to a certain point the force of its revolutions will completely drag it under, the vessel will be drawn over to its side, whilst the opposite paddle wheel will be revolving in mid air, and the vessel must to a certainty sink. This was not a bad argument in its time, but we now smile at it. The similar argument that electricity cannot act by electrolysis, and it cannot have any interpolar action, therefore it cannot act at all, is equally amusing. One would think the first thing critics would do would be to ascertain whether it does act. Then, when they have satisfied themselves on that point, they may properly search for an explanation of what they see. The effect produced cannot possibly be from electrolysis (in my opinion); whatever of this takes place, it must be so inconsiderable as to be of no account. We are told that no interpolar action can take place, but we are also told by physicists that osmosis takes place through animal membranes, whatever the density of the fluids, in the direction of the current, *i.e.*, from the positive to the negative pole. Although this may be positively true, it cannot solve the riddle, otherwise, whatever change takes place in a tumour would do so during the time the current was actually passing, and no more. It would be smaller at the close than at the commencement of a sitting, and would undergo no further diminution in size until the next. We know that this is not so, and that diminution in size takes place sometimes weeks after a sitting, and not to any appreciable extent during one. Dr. Apostoli himself appears to attribute the undeniable effect that is produced to cauterisation of the uterine mucous membrane, and I am inclined to think it acts in this way, *i.e.*, by damaging the blood vessels that supply the nourishment. We know that uterine fibromata are more erratic than any other class of tumours, increasing in size, diminishing in size, disappearing in the most unaccountable way. All this irregularity points to a precarious existence enjoyed by them, and it would appear that little is required to disturb the equilibrium between growth and retrograde metamorphosis, and to cause them actually to diminish in size. Perhaps this is not the correct explanation; if not, the right one will no doubt be forthcoming in due time; at present the need for one is not pressing.

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[*] Since writing the above I have steadily persevered with the use of Apostoli's new carbon electrodes. There is now, July 18th, a decided improvement as to size, in some of the tumours, but they are not much smaller.

Mode of Application.—It is well known that Dr. Apostoli uses a powerful continuous current battery of 24 to 36 cells, a large external electrode measuring 20 by 30 centimetres, composed of moist potters' or sculptors' clay, and a horizontal galvanometer registering up to 250 milliampères for measuring the intensity of the current. The patient is placed on her back, with the buttocks slightly projecting over the end of the couch, and the knees are separated, the feet resting on projected foot rests. The wet clay electrode is then placed over the lower part of the abdomen and connected to the battery, the vagina is then washed out with an antiseptic solution, and the internal electrode—platinum, steel, or carbon—after disinfection, is inserted into the uterus and joined up to the battery. The current is then turned on as high as the patient can bear it, or as the case requires, or is thought to be safe. In tumours, where a high tension is required, 200 may generally be given, and sometimes as high as 250 and 300, and continued from 3 to 5 minutes.

The continuous current is also used successfully for pelvic exudations (inflammatory); but in these cases the dosage need not be so high—50 to 80 milliampères, and continued 7 to 8 minutes. I have said nothing about puncturing, for the reason that I have not attempted it since June, nor have I seen a case that appeared to me to require it. It appears to me to multiply the dangers manifold; and, although I would do it if necessary, I confess I shrink somewhat from it. I have introduced one or two modifications that others may or may not think worthy of notice. First, regarding the clay electrode: It is dirty, soiling everything it comes into contact with, and necessitating a considerable loss of time from cleaning up; it is very cold for the patient, especially in the winter time, and it was that more than anything that led me to look out for a substitute. I finally hit upon one in the shape of a piece of thick chamois leather, the size of the clay electrode, 20 by 30 cm., and soaked in warm salt and water. This is cleanly, and comfortably warm. The flat tin electrode is placed upon this. Another point is the position: As the action is only on the mucous membrane, and this is cauterised wherever the external electrode is placed, and as it is not the rule to examine women in England on their backs, however necessary it may be occasionally, I have lately made the application many times with the patient on the left side, placing the external electrode over the right buttock. When applied in this way, however, the current must pass through bony parts, and bone presents great resistance to the passage of the electrical current. If only a weak current is required this does not much matter, but if a powerful current is to be used, it is better to place the external electrode over the abdomen where only soft parts have to be traversed by the electricity. It is a useful precaution to examine the wash-leather each time to see if any hole has been burnt into it at the previous sittings; a good thick wash leather will, however, last for a large number of applications. My mode of procedure is then as follows:—After the patient is placed on the back or in the usual gynæcological position, on the left side, with the knees drawn up, the part of the buttock over which the wash leather is to be placed is sponged over with hot water to take off any grease from the skin; the chamois leather, then wrung out of warm salt and water, is spread out carefully, the flat tin electrode adjusted, and the rheophore joined up. The internal electrode is then inserted, after passing it through a flame, or otherwise disinfecting it. If I intend to use the position pole, I employ Gaiffe's platinum electrode, or one of his new carbon ones: if the negative, I not unfrequently use my ordinary uterine sound, over which a piece of India-rubber tubing has been slipped, and through the handle of which I have bored a hole to receive the point of the rheophore. This is then joined on to the battery, and the circuit is complete.

Dr. Apostoli not only uses the continuous current for fibromata, but also for endometritis, parametritis, and perimetritis. For these effections, when I make use of the current, I content myself with currents of 50 to 80 milliampères, using the negative pole internally. There is one other condition in which I have found moderate negative currents useful, and that is anteflexion with dysmenorrhœa. This form of dysmenorrhœa is often called obstructive, but it is nothing of the sort. This is a point on which I have repeatedly satisfied myself by introducing a sound at the exact time the pain has been severe. This is the condition for which Bantock, in his little work on "The Use and Abuse of Pessaries," recommends Meadow's compound stem pessary. It is indeed a useful appliance, and answers the purpose very well, but not so well as the plan I have now followed for the last nine months, that is, to pass a current of moderate intensity, of 50 to 70 milliampères, about three times between two periods, using the negative pole *in utero* The negative pole is the best, as it does not leave the uterus in such an indurated condition as the positive does. As far as my experience goes, the flexure is permanently cured, although of course, no effect is produced on the anteversion that takes its place. It is also safer to use than the compound stem pessary, as cases have repeatedly occurred, in which these have been used, in which para or perimetritis has been set up.

THE CONSTANT CURRENT IN NEURASTHENIA.

The power of the constant, as well as of the induced, current to relieve pain is known to many, and it success is very striking. It has also proved useful in my hands in one or two cases of neurasthenia. The first case was that of a young girl, æt. 20, who had suffered for four years from menorrhagia, dysmenorrhœa, almost constant pain in the abdomen a little above the umbilicus, and fits of grave hystero-epilepsy, and she had even bitten her tongue in them. Thinking that the menorrhagia might be of uterine or ovarian orign, the patient was put under an anæsthetic and thoroughly examined, and those who examined her with me were satisfied, I believe, that the uterus and neigbouring organs were not at fault. The case then appeared to be a neurosis, and it was treated accordingly. The principal treatment consisted in the application of the constant current every second day. The amount used was 200 to 250 milliampères, passed by means of large electrodes, wash-leather pads, measuring at least 30 by 20 c., very moist, placed over the seat of pain in front and opposite to it behind. This was continued every second day for some weeks, and the patient eventually left the hospital relieved of her pain, her fits, and with menstruation normal. I should say that I had tried rest in bed thoroughly, and also ineffectually, before having recourse to electricity.

The second case was one in which great pain was located principally over the ovarian region, and in which menstruation was a positive torment, and perhaps not always patiently borne. Nothing abnormal was discoverable locally either in the uterus or ovaries. The continuous current applied as in the preceding case with the negative pole over the seat of pain gave almost instant relief. The constant current applied with one pole *in utero* sometimes causes a pain that lasts for some hours. It was so in this case, the pain after its application in this way was described as excruciating, the patient writhing on the couch. On placing one pole over the sacrum and the other over the abdomen the pain disappeared at once. The third was a lady who had for months walked bent forwards like an old woman from pain in the abdomen for which I could discover no cause. The constant current applied as in the preceding cases also gave instant relief; and although the pain did return later on it never became severe again. This patient compared the sensation produced by the current to the burning of a mustard plaster. It may be worth mentioning that a mustard plaster over the chest or abdomen not unfrequently produces a sleepy feeling, and sometimes actual sleep. This patient remarked that the feeling had a soothing effect, and that she was sure it would send her to sleep if continued long.

THE INDUCED CURRENT.

During the last 18 months I have been gradually drawn to a more extended employment of the induced current in gynæcology. It has long been known to be capable in many cases of relieving neuralgic pain, and Dr. Apostoli has pointed out its value in relieving and eventually curing so-called ovarian neuralgia. I have had the opportunity of seeing in his clinique patients whose ovarian region were so painful and tender that they could not bear the slightest pressure, after a few minutes' application of the induced current submit to firm pressure without any indication of pain, and declaring that both pain and tenderness had entirely disappeared. This effect seems to be produced by the rapidity with which the shocks succeed one another, and which produce a numbed, deadened feeling. The induced current has another effect in addition to this of relieving pain. Every making and breaking of contact produces the well-known muscular contractions. All muscles in the circuit take part in these contractions, whether of intestines, arteries, uterus, fallopian tubes, or broad or round ligaments. The effect produced on the uterus is well known, and may be easily demonstrated either during labour or when much uterine discharge is present. It this way it acts almost in the same way as massage, and we know this is very useful in inflammatory exudations after the acute stage has passed. The interrupted current is very properly applied, therefore, in subinvolution, in pelvic inflammatory exudations affecting the uterus, tubes, ovaries, broad and round ligaments, and also in cases of pelvic hæmatoma situated in structures surrounded wholly or in part by muscular tissues. I do not see that it can promote the absorption of intra-peritoneal hæmatoceles, unless it may do so by assisting to restore the absorbent surfaces to a normal condition through the influence of the blood vessels. So far as inflammation is set up in the peritoneum by sanguineous extravasation, the induced current might be useful, and in this way it would act indirectly on the effused blood itself. For nearly 12 months I have made a routine practice of having the induced current applied, as a rule, daily in all such cases as I have mentioned, and I have reason to be satisfied with the result. It need not cause any pain, for applications should stop short of this. It can be given by a nurse, and this removes one of the greatest difficulties to its general employment. The usual method of using it is for the nurse to apply rather large and wet electrodes over the seat of pain, or over the uterus in front and the sacrum behind, to join up the primary coil and continue the application for about 10 minutes daily. There is no need to discontinue either the douche or the electricity during the periods. The douche especially is generally spoken of as being very comforting during the period.

COMMUNICATIONS FROM AUSTRO-HUNGARY.

[FROM A CORRESPONDENT.]

THE telephonic communication between Vienna and Buda-Pest will probably not be open until about the end of November. The delay is owing to unforeseen difficulties in the construction of the telephone line which, as is known, is erected with the three leads. Such a telephonic line, of such an extent on a single line of supports, does not as yet exist anywhere. In order to obviate the serious inconvenience of sound being transmitted from one lead to another (which constantly occurs in multiple leads), a new system is being employed in the Buda-Pest and Vienna line by means of which this difficulty is removed. The Austrian portion of the line is almost complete, but the Hungarian portion—by far the longer—will not be ready before the end of October. Not until then can the trials begin, which will require at least a fortnight.

That the telephone line of Vienna-Prague is already in operation, and that telephonic communication exists between Prague and Dresden, and again between Dresden and Berlin, is known. By connecting the lines just mentioned, a telephone net will be completed from Buda-Pest to Vienna, Prague, Dresden to Berlin.

The International Electric Company has already begun the construction of its Vienna works. It will be erected on the banks of the Danube (in the Engerthor Road), and in the first place there will be about 2,000 horse-power arranged for. The installation will be carried out on the alternating transformer system, and is to serve both for supplying light and motive power. As the above-mentioned system admits of an extension of the net of cables at pleasure, it will be possible for the International Electric Company to supply light and power from their central station, also in those districts in which the firm Siemens and Halske have constructed a central station on their "five-leads" system, so that here also there will occur an interesting competition.

On the other hand, the firm Siemens and Halske propose to offer a serious rivalry to the Buda-Pest Tramway Company. A few days after the presentation of the application in which the above company applied for a concession for the construction of an electric tram line on their new system, with a vertical track—of which I have recently given you an account—the Siemens's tramways undertaking handed in an application requesting a concession for the same line and some additional lines. The competition for the electrical tramway in Buda-Pest promises to become very interesting, as the municipality will be guided in their choice by the merits of the respective systems. There has been of late a report widely circulated that Mr. Edison in passing through Frankfort-on-the-Main was interviewed by a newspaper reporter accompanied by a representative of the firm Siemens and Halske, and that he expressed himself in favour of the continuous, and against the alternating, current system. The *Neue Wiener Tagblatt* in its issue of October 17th, makes on this subject the following interesting comments :—"An interesting duel is about to come off in

Germany. The venerable, but progressive city, Frankfort, wishes to introduce the electric light. After prolonged studies and a thorough inspection and testing of the central stations in operation in various capitals, and after consulting specialists of all shades of opinion, the Municipal Commission and its technical organs decided unanimously for the alternating current system. The opinion was handed in to the town council, which required certain tests to be executed to throw a light on certain technical details. The pause before the decision is now being filled up by the rival system with an interlude which, if not harmonious, is at least very penetrating. There now appears on the Continent a clever inventor. On his triumphant passage through Germany he is button-holed at the Frankfort railway station. Why just at Frankfort? Because the agent there of an influential continuous-current firm, which is competing for the lighting of Frankfort, wants an "authentic" opinion for effective distribution, and has for this purpose come, accompanied by a reporter. The inventor of continuous-current distribution is cunningly asked: 'Are you in favour of the continuous current? Yes or no?' 'Yes.' 'Do you wish that Frankfort should commit the error of being lighted with an alternating current?' 'Oh, no.' So cunning a manœuvre may amuse the able mayor and town council of Frankfort, but not influence them."

A SYNTHETIC STUDY OF DYNAMO MACHINES.

(*Continued from page* 383.)

VII.—PARASITIC CURRENTS.

HITHERTO we have considered the E.M.F. induced in coiled conductors by their motion in various magnetic fields having given to the coils the particular shapes necessary, that the E.M.F. induced in the different parts of them, or in the several coils which form the armature, may be added together in the manner desired. But whether metal is drawn into wire and wound into coils, or used in another form, E.M.Fs. are necessarily induced in it when it is moved in a magnetic field, the difference between the two cases being that in the former the E.M.F. which is to be usefully employed has been directed as required, while in the latter currents are generated which select a direction for themselves, depending on the shape and size of the conducting substance. In the several descriptions of armature containing an iron core, it will have been noticed that this core has been invariably described as being built up of thin discs or washers separated from each other by paper or other insulating material, or of ribbon with the adjacent convolutions separated in a similar fashion, or of wire covered with an insulating varnish or a single covering of cotton. If instead of being divided in this way the iron core were solid, the E.M.Fs. induced in it would, by reason of the extremely low resistance of a large mass of solid metal, cause enormous currents to flow. The work done in producing these currents would be entirely wasted, and owing to the heat generated, the temperature of the machine would soon be raised to a destructive point. They are currents which could not be utilised, which are a source of loss, and for the elimination of which every possible precaution must be taken therefore in the construction of machines. By suitably dividing the iron core as above indicated, these so-called parasitic currents may be rendered almost negligible.

The parts of the conductors which contribute to the E.M.F. of the machine are those parts only which cut the lines of force, the induction being at right angles to the direction of the motion. The induction tending to produce parasitic currents is obviously in the same direction, and to prevent the formation of the latter, the iron core upon which the conductors are wound must have planes of division perpendicular to the direction of the induction, and parallel to the direction of motion. By these means the mass of the core is divided and an enormous resistance is interposed in the path of the induction, the parasitic currents being, in consequence, rendered quite innocuous.

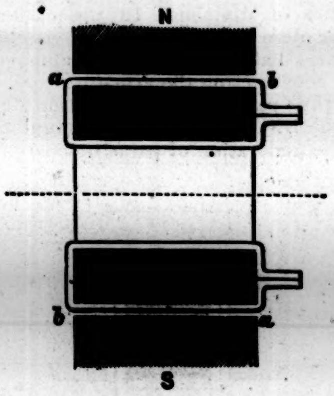


FIG. 129.

Fig. 129 shows the lamination of the armature in a Gramme ring as usually constructed. The core is built up of soft iron washers, clamped together, and separated from each other by varnished paper, the conductors being wound over the exterior, and through the interior of the ring. N and S are the magnets, the lines of force entering and leaving the ring by its external cylindrical surface. The direction of induction in the conductors is at right angles to the direction of the motion, that is from *a* to *b*, or *b* to *a*, according to the direction of rotation, while the planes of lamination, as shown at A, are parallel to the direction of motion, and perpendicular to the direction of induction. The Siemens armature is laminated in the same manner, the core, in this instance, being built up of thin discs of soft iron, with a hole left in their centre sufficiently large to admit of attachment for driving. The iron sheet from which these washers or discs are cut vary in thickness from No. 16 to No. 22 B.W.G., or from ·065 inch to ·028 inch. The former is seldom employed, the general opinion being that the thickness is too great, while the latter is not infrequently used through a medium size of No. 20, or ·035 inch is the size most commonly adopted. The insulating material consists generally of thin tough paper, varnished or unvarnished, of thin asbestos paper, or of Willesden paper; in some cases oxide paint alone is used, though this practice cannot be recommended. When No. 20 sheet is used, the number of washers or discs is about 25 to the inch, allowing for a good tough paper between each plate.

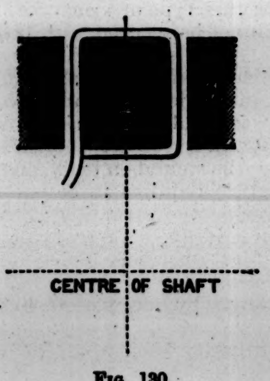


FIG. 130.

In fig. 130 is shown the direction of lamination in a disc armature, the core of which is constructed by winding on a central ring a ribbon of soft iron, along with a ribbon of asbestos paper, the core, A, when finished, forming a laminated structure with the planes of lamination perpendicular to the direction of induction, and parallel to the direction of motion. N and N are the magnet poles by which the lines of force enter the ring, and it will be noticed that here, as in the Gramme and Siemens armatures, as must in fact be the case in all armatures, the lamination is such that the lines enter and leave by the *edge* of the iron, or parallel to the planes of division. In the earlier days the necessity for observing this was not recognised, and in disc armatures flat washers were employed instead of ribbon for constructing the armature core. The lamination was thus parallel to the direction of the induction, with the result that a large amount of work was wasted in the generation of parasitic currents.

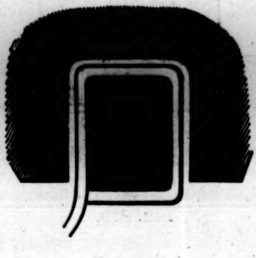


FIG. 131.

If the magnet pole embraces the circumference as well as the sides of the disc, fig. 131, the lines of force enter the core by three sides, and the conductors become inductively active on the top as well as on the sides. In this case the core should be made of rectangular iron wire covered with a single layer of cotton to prevent adjacent wires from being in contact. Wire is specified because it is only by its use that lamination at right angles to the direction of the induction on all three sides of the core can be properly secured. In some cases a few radial slots have been turned out of the core as shown in fig. 132, with a view to the prevention of parasitic currents on the circumferential part of the armature, but the device has not proved very successful, as the degree of lamination thus obtained is insufficient. A mechanical objection to the wire core for this type of armature arises from the fact that there cannot be secured with it quite the same rigidity as when ribbon is employed. To the use of wire in Gramme or Siemens armatures there arises no objection from this point of view, as it can be wound on a gunmetal body between end flanges, as shown in fig. 133, but there comes with its use the constructional objection that it cannot be wound on truly, and that in consequence the armature requires to be put into the lathe several times during the operation of winding for the purpose of truing it up. There is no advantage in employing wire for the cores as depicted in fig. 129, save on the score of economy, for the parasitic currents are eliminated in these by lamination in one direction only. All wire cores possess the disadvantage of having the magnetic continuity broken, as the lines of force entering the armature have to pass through several thicknesses of insulating material before getting to the bottom layers of wire. This means that greater magnetising force must be employed. It is certain that in wire cores the lamination cannot be so perfect as in sheet ones, until the wire gets very small in section, which leads to farther trouble in the truing up. The use of wire instead of plates seems, on the whole, doubtful economy, and having found a decided saving in the use of plates, we are of opinion that wire should be employed only when it cannot be done without.

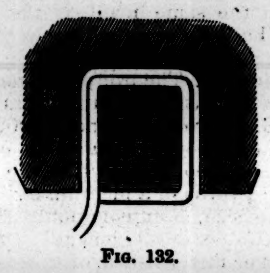


FIG. 132.

In alternating current machines the same rules are followed for the lamination of the armature cores. The alternators with their coils wound as in the Gramme machine have their armature cores, whether stationary or rotating, made of soft iron washers, while disc alternators with poles on each side of the armature, as in fig. 130, have their cores made of ribbon, with insulating material between the adjacent convolutions. The alternators in which the armature coils are laid on the surface of an iron core have the latter, whether fixed or moving, built up of washers, separated from each other by an insulating substance. Alternators in which the iron cores of the field magnets are subjected to inductive action, due to a magnetic flux varying in intensity and distribution, require to have the magnet cores also laminated, in order that there may be generated in them no parasitic currents. But the rule for the lamination of the magnet cores is the same as for the armature, namely, that the planes of division shall be perpendicular to the direction of the induced E.M.F., and parallel to the direction of the motion.

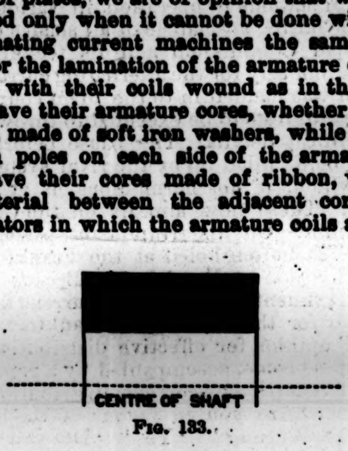
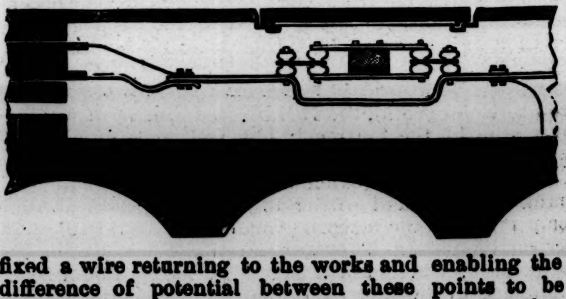


FIG. 133.

(*To be continued.*)

THE KENSINGTON AND KNIGHTSBRIDGE CENTRAL STATION.

AMONG the central stations worked by accumulators in London, one of the earliest is that of the Kensington Court Electric Light Company, situated in High Street, and established by Messrs. Crompton & Co. This is, moreover, the first station to make use of underground canalisation in naked copper. The distribution is effected by feeders under the mean potential of 100 volts. The feeders, as shown in the accompanying figure, reproduced from *L'Electricien*, are insulated and placed in trenches of brick under the pavement; at the point where they join the distributing system is fixed a wire returning to the works and enabling the difference of potential between these points to be measured and kept constant. The system of distribution consists of a thick band of naked copper, suspended to the middle of a wide trench. For this purpose, at certain intervals across the trench, are placed beams of wood fixed in the sides and supporting, by means of irons, two insulators of varnished glass; these are connected with other insulators fixed upon the band of copper by a cord which serves at the same time to stretch the conductors.



At intervals are holes, closed by an air-tight slab, through which the canalisation can be inspected. The derivations for the consumers are established all the more easily in London, as the cellars extend underneath the footpaths; it is then sufficient to make a hole in the bottom of the trench so as to let the wire pass through, which is fixed upon the canalisation by means of little bolts.

The station contains three Willans and Robinson steam motors working directly some Crompton machines, making 350 revolutions per minute, and giving 900 ampères and 110 volts.

The accumulators of the Crompton-Howell type are always mounted in derivation upon the machine, and absorb or restore energy according to the charge of the circuit of utilisation. A commutator, made specially for this purpose, enables the number to be varied without the circuit being cut.

PROFESSOR THOMSON'S EXHIBITS AT PARIS.*

IN the private exhibit of Prof. Thomson there is an apparatus shown which puts in motion a steel tape by the vibration of a diaphragm, a drawing of which is given herewith, the diaphragm being partly broken away. A horseshoe shaped electro-magnet, E, fig. 1, is supported horizontally in front of an upright metallic diaphragm placed about one-eighth of an inch from the poles. An endless iron tape, A, passes through a small hole in the centre of the diaphragm, D, and between two jaws attached to the same, and thence over guide wheels. When an alternating current is passed through the coil it produces a vibration of the diaphragm, which, being communicated to the jaws, forces the tape outward through the diaphragm. While the tape passes over the pulley nearest the diaphragm in one direction, the pulley, B, curiously enough, revolves in a direction opposite to what it would under ordinary circumstances. This very curious phenomenon has not yet been satisfactorily explained, but is no doubt due to the results of compound vibrations in the apparatus.

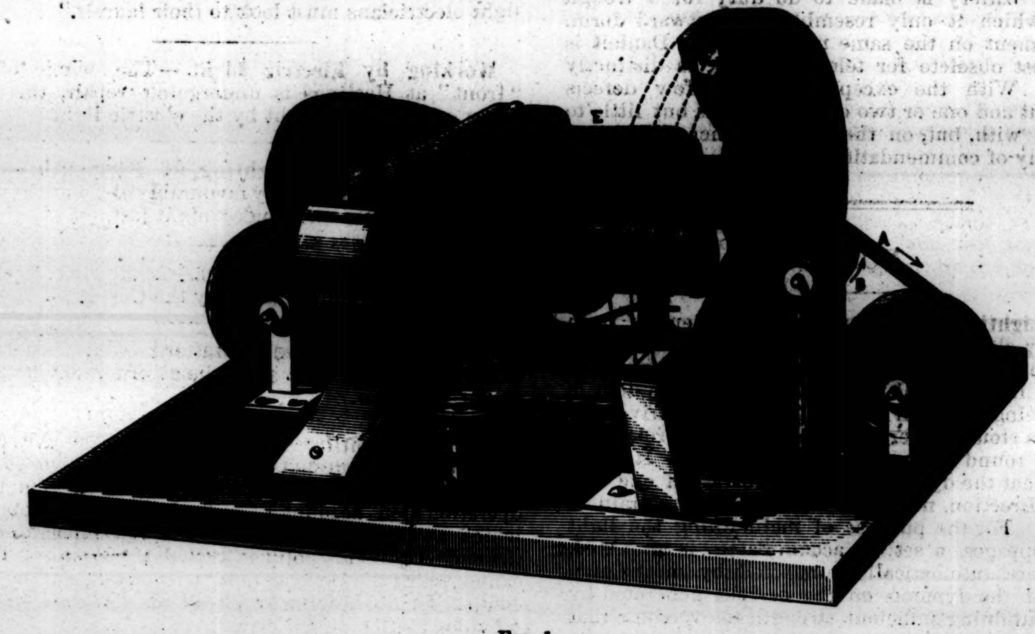


FIG. 1.

Besides this there are a large number of other interesting things shown. One of these is an alternating current motor, fig. 2, which is started with the brushes in contact with the commutator, but when the motor has attained its proper speed the brushes are removed from the commutator and the machine then runs as a simple induction motor.

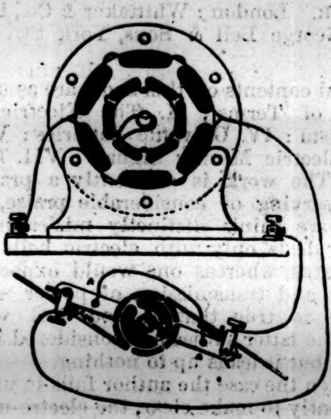


FIG. 2.

It is a multipolar machine, the field magnets consisting of six coils which are wound in opposite directions and fixed inside a laminated frame. The armature also consist of six similar coils attached to the outside of an iron disc core.

A little mechanical assistance has to be given to the motor to start it, but it quickly gets up to its normal speed, about 1,500, the brushes being meanwhile shifted till all sparking is avoided. Once, however, it has got into the same phase as the dynamo which is supplying it with current, the brushes are rocked backward until they touch the contacts, A, A, which immediately short-circuits the brushes and lifts them off the commutator, thus cutting the armature completely out of circuit. The motor then continues to rotate by induction from its field. An arrangement is attached to the motor shaft to short-circuit automatically the armature when the motor is in phase. Two semi-circular segments, which will be noticed inside the commutator, fly outward by centrifugal force and abut against the commutator segments, thus short-circuiting them when the right speed is attained.

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* Abstract from article in New York *Electrical World* on Paris Exhibition.

REVIEW.

Electricity in our Homes and Workshops. By SYDNEY F. WALKER. London : Whittaker & Co., Paternoster Square ; George Bell & Sons, York Street, Covent Garden.

The general contents of this book are as follows :—I. Glossary of Terms ; II. The Electric Circuit ; III. Magnetism ; IV. Galvanic Batteries ; V. Electric Bells ; VI. Electric Mining Signals ; VII. Telephonic Apparatus. The work is eminently a practical one and it is deserving of considerable praise, the title, however, is we think distinctly misleading as the author really deals only with electric bells and telephonic apparatus, whereas one would expect that the electric light and transmission of power were to be included. It is true that a good deal which has reference to the latter subjects is considered in the first two chapters, but it leads up to nothing.

As is so often the case the author fails to understand, and consequently to make clear, the electro-mechanical units ; for instance on page 17 he says, " the watt is the unit of work done and is equal to $\frac{33000}{746}$ foot lbs.," but a few lines further down he says, " the watt is equal to $\frac{33000}{746}$ foot lbs. per minute."

Chapters IV, V, VI and VII, which, form the bulk of the book, are eminently practical ; we notice, however, that on page 80, an illustration of a trough Leclanché battery is made to do duty for a trough Daniell, which it only resembles in outward form. The statement on the same page that the Daniell is now almost obsolete for telegraph work is distinctly incorrect. With the exception of the few defects pointed out and one or two others, there is but little to find fault with, but, on the contrary, there is a good deal worthy of commendation.

NOTES.

Train Lighting by Electricity.—A system of train lighting by electricity was introduced by the Cheshire Lines Committee on Saturday last. The electricity is generated in the break van, on Radcliffe's system, a dynamo being fixed in the brake van, and driven by means of a stout leather belt, which passes through the floor and round the axle of the vehicle. It is so arranged that the dynamo always revolves in one and the same direction, no matter which way the train is travelling. For the purpose of maintaining the light during stoppages, a set of accumulators is provided, and these are automatically connected by means of a switch with the dynamo on the current generated by the latter attaining sufficient strength to overcome that of the accumulators.

Electric Lighting at Bradford.—The Gas and Electric Lighting Committee of the Bradford Corporation have more than exhausted the £15,000 which was granted some time ago for the purpose of establishing works for supplying the inhabitants of the town with the electric light. At a special meeting of the Town Council on Saturday, an additional sum, amounting to £25,000, was granted in order to enable the committee to complete the works begun, and also to enable them to meet the extra and unexpected demand for the supply of the electric light.

The Lighting of Wimborne.—At the last meeting of the Wimborne Board of Guardians it was announced that two tenders had been received for lighting the town, one from Mr. W. J. Bacon and the other from the Wimborne Gas Company. Mr. Elcock suggested that they should wait and see what the electric light company intended doing in the matter, but the Guardians decided not to wait, and accepted the gas company's tender.

Electric Lighting at Exeter.—The electric light is making rapid progress at Exeter, and is being adopted in most of the public buildings. The Half Moon and Clarence Hotels have recently been fitted up with the electric light, and the arrangements work satisfactorily. The hotels were illuminated for the first time on Monday evening. In each case the installation consists of 130 Edison incandescent lights of about 2,000 C.P. each, which throw a steady light on all parts of the buildings. Every light is under separate control. This public display will do much towards recommending the light to the townspeople of Exeter.

Barnsley and the Electric Light.—An installation has been completed at the foundry of Messrs. Qualter and Hall.

A Long Incandescent Circuit.—In reference to the long distance circuit the *New York Electrical World* says :—" The Heisler Company inform us that the circuit there (Ottawa) is actually 45 miles in length. They believe this, with reason, to be the longest incandescent circuit in the world, and they question whether it is approached by an arc circuit. If our readers know of anything that at all approximates to this, we shall be glad to hear from them. It is certainly a most remarkable instance of flexibility of system and of the delivery of electrical current at an extremely remote point. As we hinted in our note on the subject, arc light electricians must look to their laurels."

Working by Electric Light.—The whole of the "front" at Hastings is undergoing repair, the work being continued at night by the electric light.

Proposed Electric Lighting at Plymouth.—This matter was discussed very favourably at a meeting held at the Athenæum on Monday night last.

Electric Lighting of Wigan.—Application is to be made for a provisional order by the Corporation.

The Electric Lighting of Stafford.—The Corporation is about to apply for a provisional order for the lighting of the town.

Electric Lighting in Newcastle.—The *Newcastle Chronicle* is requested to state that the two electric lighting companies have been unable to commence operations on account of a technical point of law, which awaits the decision of the law officers of the Crown. Until this point is settled, the Board of Trade cannot grant the licences, and, of course, meantime the companies are absolutely powerless. We stated in a previous issue both companies are quite ready to commence operations directly the licence arrives.

Electricity at Calais.—The new Calais Harbour Station, which is to be lighted entirely by electricity, was opened for traffic on Monday.

Proposed Electric Lighting at Eastbourne.—The lighting committee of the Eastbourne Town Council reported to the last meeting that, " At a meeting of this committee, held October 17th, a letter was read from Messrs. Langham and Sons, solicitors, on behalf of the Eastbourne Electric Lighting Company, Limited, enclosing, for submission to the Corporation, a draft of the provisional order which the company proposes to apply for to supply the electric light within the borough of Eastbourne, and stating that the directors of the company will be happy to consider any suggestion which the corporation might desire to make upon the subject." It was resolved that a special meeting of the Council should be convened to consider the advisability, or otherwise, of the corporation giving consent to such provisional order.

Electric Lighting in Brussels.—It will be remembered that the Town Council of Brussels has invited the presentation of schemes for the introduction of the electric light throughout the town. Six firms have submitted their plans, which comprise various well-known systems, but amongst these is one which is novel. This plan, says *Industries*, has been prepared by M. Van Rysselberghe, the well-known inventor of the long distance telephone system. He proposes to distribute not electric current but hydraulic power, and to generate the current by means of hydraulic motors placed on the premises of the subscribers. The cost of having the current from a distance to the point of consumption, in the case of the Théâtre de la Monnaie, enormously increased the total expense of the installation. In this case the current is furnished by the gas works at Laeken, and the whole installation has cost 180,000 francs, whereas a local plant could have been put up for 20,000 francs. According to Van Rysselberghe's present project, large pumping stations would be erected outside of Brussels, and water under a pressure of 750 lbs. would be conveyed by means of various sub-centres, where small local generating plant would be established.

Edinburgh Exhibition.—Sir Thomas Clark, Chairman of the Executive, presided over a large number of guarantors on Friday last. The Chairman mentioned that the guarantee fund had reached £22,000, but it had been proposed that the fund should still be kept open, and they would soon, he thought, have £30,000. He moved in accordance with former resolutions, that it be remitted to the Executive Council to carry out the exhibition, which was unanimously adopted.

Repeal of Chilian Import Duties.—The *Financial News* says:—"Manufacturers will, perhaps, note that the Chilian Government has decided that after January 1st, no import duties will be charged on tools, machinery, railway plant, or materials for telegraph and telephone installations entering Chili. That should benefit this country more than any other, provided we don't let any rival cut in before us."

The Telephone Extension in Russia.—We hear it is proposed to organise a new telephone service between Moscow and St. Petersburg, a distance of 400 miles.

New Catalogues.—We have received from Winfields Limited, a copy of their book of patterns of electric light fittings, to which we have already alluded in a previous issue. This publication is one of the evidences that at last the Birmingham firms who have been foremost in the production of gas fittings are beginning to recognise the fact that the electric light is becoming a formidable competitor with the older illuminants. One would have expected that some of the more progressive firms, at any rate, would, ere this, have taken a more prominent position than they have done in the manufacture of metal fittings, but better late than never, and the book now referred to shows that the old-established house of Winfields is prepared to supply fittings for the electric light in a great variety of patterns in brass, brass and copper, and iron. Some of the wrought iron work with copper enrichments appear particularly effective, and almost equally so that in a combination of polished brass and copper. From the Electric Supply Company of Chicago we have received their list, No. 560, of electric light and power supplies. For completeness, accuracy of detail, originality of arrangement, and excellence of printing and illustrations, this is probably the most complete list of the kind ever issued. Its value is enhanced by the addition of some valuable tables and formulæ compiled by the highest electrical authorities, and now presented with such modifications as are suggested by the latest knowledge and investigation.

Electrical Business on the Tyne.—Electrical firms in Newcastle are having a very prosperous time, and provision is being made for a large extension of manufacturing facilities. In addition to the works being erected for Messrs. C. A. Parsons & Co., a large addition is being made to the present works of Messrs. J. H. Holmes & Co., which only a couple of years or so ago were put up on a scale which it was supposed would be sufficient for the business they could reasonably hope to secure. Messrs. Ernest Scott & Co., who have more recently entered the lists as makers of electrical machines and lamps, are making most important alterations at their works, including the construction of an erecting shop, 90 feet by 45 feet, with a 15 ton overhead traveller, and special engine for testing dynamos to give up to 100 horse-power. There is also a new pattern shop and drawing office, 90 feet by 30 feet, with wood-working tools of the latest designs. The brass finishing shop is also being doubled, to cope with orders for switches, lamps, and other descriptions of electrical brass work. They have in course of construction as many as 50 dynamos (varying in size from 25 to 700 lights) of the new type introduced by Mr. Mountain. They are also turning out a large number of arc lamps for both home and foreign orders. A speciality of this firm is high-class brass and gun metal castings, which are made from the smallest size up to 10 tons weight, the foundry being the largest on the Tyne. On the occasion of a recent visit to these works, we were shown a very compact combined engine and dynamo for 100 lamps for ship work, the engine speed being 350 revs. per minute. We hope to have the opportunity of illustrating this in a future number. The firm is busy also in fitting up installations in mills in the Lancashire and Yorkshire district, as well as a large mansion near Tenby, and recently completed the lighting of the River Wear Commissioners' chain testing shop at Sunderland by means of a Griffin gas engine and an 80-light dynamo. A special search head lamp attached to the men's caps, and used for examining the chain links, was designed by the manager of the department, Mr. Hartness.

American Electric Street Railways.—The New York *Electrical World* published in a recent issue a table of electric railways, from which it is seen that there is a total of 1,260 miles of track and 1,884 cars operating on 179 roads.

Dick, Tom and Harry.—It is well not to entrust the wiring of your home to any of the above. Quite recently the inhabitants of three consecutive houses gave orders for their respective residences to be wired during their absence from London, and were surprised, dismayed and disgusted to find on their return that the Electric Supply Company declined to turn on the current owing to defective insulation.

A New Electric Submarine Boat.—A new boat has been introduced by Lieut. Halpine, of America. It is propelled by an electric motor and storage batteries. The boat is in shape a large metallic cylinder pointed at both ends, in which the motor and battery are contained. The weight of these is so disposed that the vessel is kept at a proper depth and position in the water. The boat is kept under the control of an operator on shore or on a ship by means of special electrical mechanism on the boat, connected by single insulated wire with switching mechanism, and a portable battery at the operator's position.

A Chance for Electric Traction.—Tenders are wanted for working, under lease, of about 11 miles of tramways for the Corporation of Huddersfield. The lines are laid so as to be suitable for either animal or steam power (and, we imagine, electrical traction). The Town Clerk will supply all particulars.

Report of Electrical Trades Section London Chamber of Commerce.—*Overhead Wires.*—Three meetings of the committee were held, and Major Cardew was consulted on several occasions by the correspondent and by other members of the committee about the interpretation and modification of the rules. A letter was written to Mr. Courtenay Boyle, asking for certain minor changes. The alterations effected by the action of the Chamber were in the definition of "low pressure," which was altered from 300 volts to 600 volts if the system be earthed in the middle; and in the definition of the materials to be used for insulation, the word "India-rubber" being omitted. It is believed that the Board of Trade are instituting tests of silicium and other bronze wires, with the view of granting further concessions, if possible, for wires taking their own weight, without bearers; but at a full meeting of the Council of the Institution of Electrical Engineers on the 25th inst. it was decided that they were not at present prepared to recommend any alteration of rule 12.

British Association Screw Thread.—186 circulars were sent out, and only 20 replies were received. These came to hand just before the meeting of the British Association at Newcastle, and as the Association exists practically for only one week in each year, except for purposes connected with its own organisation, a letter was written to the secretary of the Mechanical Section giving an analysis of the replies, in the hope that the Association might take some steps to popularise the matter. It appears, however, that as the Screw Thread committee has been dissolved, and the committee of the section is merely constituted to arrange the papers to be read at the meetings, no notice was taken of the communication. When the Post Office decided to adopt the B.A. thread in the construction of its instruments, Mr. Th. Lehmann, of 28, Hampshire Street, Torriano Avenue, N.W., was appointed to manufacture the taps, screw-plates, and dies, and to supply them to the Post Office. Of Mr. Lehmann, whose name is not familiar in engineering circles, it is sufficient to say that he was formerly manager to Mr. Stroh, and superintended the construction of the most accurate work on the instruments for the Telegraph Department of the Post Office. At the invitation of the correspondent, a box containing a set of tools is exhibited by Mr. Lehmann. Mr. Preece has kindly lent a sample set of tools, and a case containing a sample of every kind of screw used by the Post Office. Messrs. Davis and Timmins also exhibit samples of screws.

Standardising Laboratory.—At the request of the Board of Trade, 212 circulars were sent out, and 13 replies containing returns, together with six blank forms with letter explaining reasons for not replying, were received. The totals were as follows: House meters, 1890, 6,160; 1891, 13,100. Ammeters, 1890, 400; 1891, 581. Voltmeters, 1890, 556; 1891, 891. A letter containing these totals was forwarded to the Board of Trade, calling attention to the fact that only two supply companies had been able to estimate their requirements. With regard to the establishment of a laboratory, it is believed that Her Majesty's Treasury continues to give the matter its most careful consideration.

Employers and Workmen.—It is said the Thomson Electric Welding Company, of America, has requested every man in their employ to sign an agreement to assign any patents they may obtain to the company, the men receiving a substantial recompense.

Prize for Electric Time Signals.—The American Naval Observatory has been awarded a Grand Prize for its exhibit of electric time signals at the Paris Exposition.

The Western Union Telegraph Company of America.—The official figures show that in ten years the company has increased its mileage 115 per cent., its messages 116 per cent., its offices 116 per cent., and its wires 206 per cent. Revenue for the year ending June gives an increase of over one million dollars.

A Grievance.—An inhabitant of Victoria Street writes to *Truth* as follows:—"In other parts of London electric companies are laying electric wires. Here nothing is being done. Our parish authorities must be up and doing. Either the company or companies which have acquired powers to light us must at once lay wires, or the parish authorities ought to take the matter in hand themselves. It is absurd to suppose that we can await the good pleasure of speculators. I am one of those who have always regretted that electric lighting has been allowed to fall into the hands of private companies. It seems likely to prove a remunerative business, and it would have been far better if it had been undertaken by the parishes. To erect a central station, and to run wires under the pavement, is no very huge undertaking. I would have the company or companies concerned notified that, if they are not prepared to give a guarantee that all will be ready in—say, two months—the parish will itself do the job."

Belgian Exhibition in London, 1890.—It has been decided that the fourth in the series of National Exhibitions at Earl's Court, London, shall be a Belgian one. The work of organisatian connected with the first two of the series, the American in 1887 and the Italian in 1888, devolved principally upon the initiator of these useful and instructive exhibitions, Mr. John R. Whitley. After careful examination Mr. Whitley, who is accompanied by his friend and colleague, Mr. Vincent A. Applin, has come to the conclusion that the support offered by the Belgian Government, and the enthusiasm shown by Belgian manufacturers and artists, will ensure a greater prospective success for an exhibition of Belgian art, industries and products than that of any other nationality. Mr. Whitley has already invited Colonel J. T. North to be President of the Reception Committee which will be constituted, and arrangements are being completed to take over to London some of the best Belgian exhibits from the present Paris Universal Exhibition, and the paintings from the celebrated Wiertz Gallery in Brussels.

A Disputed Electrical Contract.—At the Torrington County Court, on Monday week, Messrs. Walter Robotham and Co., electric lighting engineers of Manchester, sued Mr. Thomas Fry, miller, of Wear Gifford, Devon, for the recovery of £30 14s. 6d., being the balance due on a contract, having reference to the electric lighting of his house and mill. The action was originally commenced in the High Court, but had been remitted to the County Court for trial. Defendant set up a counter claim of £15, viz., £10 damages, sustained by himself owing to plaintiffs' servant absenting himself from the work, whereby defendant's business was interrupted, and £5 12s., representing money paid by the defendant to workmen to assist the plaintiffs' servant. The case was heard by Judge Paterson and a jury. A verdict was returned for the plaintiffs of £9 on their claim of £30, and a verdict of £3 for the defendant on his counter claim.

A Physical Society for Liverpool.—It is proposed to form a Physical Society in Liverpool, which will hold its meetings at University College, and Prof. Oliver Lodge has consented to be nominated as first president. The preliminary meeting will be held in the Physics Theatre of the University College, at eight o'clock, on Wednesday evening, November 6th, Prof. Oliver Lodge in the chair. Local students and all others interested in the subject are invited to be present. The Secretary (*pro tem*), is Mr. Thomas Tarleton, 1, Hyde Road, Waterloo, Liverpool.

Birmingham Exhibition.—It is said the awards which have been issued by the judges are giving the greatest dissatisfaction.

Adjustable Contact Switches.—Nicholson and Jennings's patent switches have been specially designed to overcome a fault which exists in every form of switch now in use, viz., that when the contact surfaces require adjusting, the act of screwing throws the contacts more or less out of parallelism, and thereby diminishes the surfaces, and causes heating. They are adjusted by tightening screws, which may be used while the switch is in use, the slots being so arranged that automatic parallelism of adjustment is certain. As introduced by Messrs. Nalder Bros., they have ebonite handles, and are mounted on polished serpentine bases, and are thoroughly mechanical in construction and well finished.

New Light Standard.—A new pattern of the Violle Light Standard has recently been devised by M. Carpentier. In the new arrangement, the fusion of the platinum is effected by a jet of mixed illuminating gas and oxygen, which plays upon the platinum ingot placed in a hollow in a block of lime. This block is in two parts, the upper part (through which the gas jet passes) being movable by means of a handle. The lower part of the block is arranged so that it can be slid from under the upper block to a position beneath a shield with a hole in the centre, whose area is 1 square centimetre. An inclined mirror above this shield enables the surface of the glowing platinum to be seen at right angles to the same. The handle enables the upper half of the block to be moved aside, so that it can be seen if the platinum is melted. The whole arrangement seems well adapted for the purpose, and would not be expensive in first cost, nor difficult to manipulate. The use of oxygen gas is now so common for lanterns, &c., that a supply in iron cylinders is always purchaseable, and therefore the employment of the melting jet is practically a simple matter.

Electric Railways.—According to a German return the number of electric railways in Europe at the end of last year was 11, of which the oldest, the Litchterfeld-Berlin Railway, was opened in 1881, being 1½ mile in length, with one motor and car, and carrying yearly 100,000 passengers. The latest is that opened at Brussels last year, with five motors and cars. The other lines, their year of opening, length, and number of passengers carried by them, are:—From Frankfurt to Offenbach (1884), four miles, with a maximum number of passengers in one year of 990,000; at Brighton (1883), one mile, 1,000,000 passengers in all; at Portrush (1883), six miles, 100,000 passengers a year; from Moedling to Hinterbruche (1884), 2·8 miles, 340,000 passengers; at Blackpool (1884), two miles, 300,000 passengers; at Bessbrook (1885), three miles, 300,000 passengers and 30,000 tons of goods annually; and, finally, at Hamburg, opened last year, and for which there are as yet no returns. It is added that at New York the working expenses of horses are 5½d. per mile, against 3½d. per mile when the cars are driven by electric accumulators.

Lighting of Omnibuses.—Mr. Still asks us to state that the batteries used in the omnibuses mentioned in a recent issue are the Schanschieff, purchased by his firm for Mr. James Willing, and are found the best for the purpose up to the present.

The Reduction of Hungarian Telegraph Tariffs.—The *Financial News* says the reduction of telegraph charges in Hungary to a penny for 10 words looks as if the Hungarians find the post or the carrier's cart quite quick enough for the transmission of their ideas. The full force of this concession cannot be understood until the length of some of the words in the language is remembered. As one word can be made to carry a sentence, 10 words should be able to carry a leading article.

The Electric Light in the West Indies.—The British Acting Consul-General at Havana states that in December last the Spanish-American Gas Company made arrangements with the Westinghouse Electric Company, of Pittsburg, to purchase from them an electric lighting plant, or, as Her Brittannic Majesty's representative somewhat quaintly styles it, "an electric light outfit." The plant consisted, in the first instance, of three vertical steam boilers, of 150 horse-power; one compound condensing engine, of 185 horse-power; and one 75 horse-power; one alternating current dynamo, of 1,500 16-candle-power incandescent lamps, and two arc light dynamos. Considerable extension of lighting is contemplated during the present year, the demand for the new light being great, and a local government order, requiring that all theatres and places of amusement shall be lighted by electricity in the course of the autumn.

Club Lighting.—Mr. T. White, of 9, Mill Street, Hanover Square, W.C., has received the order to fit up the electric installation at the Hurst Park Club, West Molesey, Hampton Court, comprising about 300 incandescent lamps, 16 C.P.; 3 Sunbeams, 1,000 C.P.; 7 arc lamps, 4,000 C.P. Power is to be supplied by the Immisch Company from their charging station at Hampton Court, on the opposite side of the river.

The Electric Light and Water-Colours.—A gentleman writes as follows to the *St. James's Gazette*:—Now that the electric light is being generally introduced into our houses, it may be well to caution those possessing valuable water-colour paintings against placing the electric lamps in close proximity to their pictures, as I have found, after three years' experience of the electric (incandescent) light in my own home, that so placed, the new illuminant is sufficiently powerful to cause some of the more delicate pigments to fade to a greater or lesser degree. Water-colours that are safe in diffused daylight are certainly not always so when exposed night after night, for many hours, to the active white light of electricity close at hand. In reply to this a correspondent to the *Standard* writes:—"It may be of interest to know that when daylight and an incandescent lamp of equal intensity, as measured by the shadow test, are compared for active power, daylight is far more powerful. Two sheets of sensitive (chloride of silver) paper for photographic prints were exposed, one to weak diffused daylight on a wall and the other immediately under an incandescent lamp (16 candle) with an opal reflector on the top of it. The lamp was adjusted to give about the same depth of shadow as the daylight. The half of each paper was protected from the light for comparison. After four hours the one exposed to weak daylight was considerably coloured on the exposed half, and the other paper under the electric light showed absolutely no difference between the exposed and the protected parts. It is, therefore, surprising to hear that the light from an incandescent lamp is more dangerous than diffused daylight to water-colour paintings; it is certainly less active to photographic paper. Chloride of silver paper can be toned and finished under a bright light from an incandescent lamp, without being in the slightest degree affected by it."

Social.—The first of a series of concerts to be held this winter was given at the Edison and Swan Company's works, Ponder's End, on Wednesday evening, 23rd ult. A good programme was provided, concluding with an interesting comedietta. The performances of the several ladies and gentlemen were much appreciated by the workpeople and their friends, who attended in large numbers, *encores* being frequently asked for. Mr. Edward Gimingham, who is interesting himself in the social welfare of the workpeople, acts as secretary to the concert committee.

The Electric Tramcar System in Birmingham.—The *Birmingham Daily Gazette* says:—A public trial of the first of a dozen electric cars, which the Birmingham Central Tramways Company hope to adopt upon the Bristol Road route, was made on Wednesday afternoon on the Sparkbrook line. The experiment had been anticipated with interest, not only by a considerable section of the public in Birmingham, but also by a large body of specialists in electrical science and tramway management. It is described as the outcome of a recent union of interests between the Julien, the Sprague, and the Electric Power Storage systems. The degree of success already attained, which is the best promise of further development, is due to a happy combination of electricity with mechanical science. The gentlemen who have taken the most prominent part in solving this problem are Mr. Thomas Parker (Elwell-Parker, Limited, Wolverhampton), and Mr. Alfred Dickinson (consulting mechanical engineer to the Tramways Company). The electrical energy is obtained from a dynamo machine, driven by gas or steam; and there is a motor on the front bogie of the car, and the accumulators in which the electrical energy is stored are placed under the seats, entirely out of sight. These accumulators will be charged at the central depôt to be constructed for the purpose, and placing them in the car from the outside will occupy no more time than a change of horses. The gearing appliances have been introduced and patented by Mr. Alfred Dickinson, and it is claimed that their adaptability to electrical motive power is one of the secrets of Wednesday's success. They are on the helicon principle, and by an ingenious system the car is enabled to travel smoothly round the sharpest curves on the Birmingham tramways. The running was perfectly smooth and quiet, and in every respect the new car satisfied, if it did not exceed, the most sanguine expectations. The route taken was a severe test for an electric car, but the success with which the journey was accomplished removed all doubt as to the difficulty of ascending steep inclines by electric motive power. The hill in Bradford Street has the steepest gradient on the tramcar in Birmingham, being 1 in 17, and the new car ascended it without the slightest hitch. On level ground a speed of eight miles an hour can be attained; beyond that it will be impossible to exceed, because at that point the motor becomes a charging dynamo, and uses the energy of the car to set up an opposite current. Experiments made several times, particularly in coming down Bradford Street, showed that the car can be stopped in less than its own length. The car has been built by the Midland Railway Carriage and Waggon Company at Shrewsbury, and is of light construction. It is lighted with electricity; it is capable of running 70 miles with a single charge of electricity, and the accumulated energy is only exhausted by the motion of the car. Thus the motive-power expended in Wednesday's trip was placed in the car several days ago.

Birmingham Exhibition.—This Exhibition closed yesterday after a most successful run. On the evening of the 29th a supper was given by the firms exhibiting to the electrical and engineering staff, when 75 sat down and spent a pleasant evening together. An eccentric programme of songs was prepared by Mr. Aspinall, one of the electric light engineers at the Exhibition. Recollecting the vagaries of the electric crane when first erected, it strikes us as very appropriate that the representative of Messrs. Crompton & Co. should be put down to sing, "Let me Down Gently;" Mr. E. W. Lancaster was also appropriately given the song, "China, Real China." Probably the other items of the programme were equally suggestive to those who were well acquainted with the history of the show.

A Russian Exhibition.—It is said there is to be at Warsaw this month an exhibition of the various Edison inventions.

The Patent Office.—The following letter from "Inventor" has arrived too late for our correspondence columns:—"Could you or any of your readers inform me if, and where, I can obtain or peruse abstracts of electrical patents from the beginning of 1883 up to the present time, *indexed*. Up to 1883 the patents have been most carefully and intelligently abstracted by Mr. Lloyd Wise in that valuable book of reference, 'Electric Illumination.' It seems to me that if the Patent Office and its regulations had been designed with a view to prevent the would-be inventor from ascertaining whether his ideas had or had not been anticipated, its efficiency could not possibly be called into account; but as it was, I believe, ostensibly founded to assist him, I cannot but think its usefulness is of a negative character. For instance, what use is the Office to a man who has to work hard all the day, if it is closed at 4 o'clock; and the hours ought rather to be suited to this man's convenience than to those of the man of leisure, who merely pays his patent agent so many golden guineas to search for him. Again, there lie on the tables of the Patent library what are called 'indexes,' but which are really nothing more than lists. There is an index for each year, and if you look—under 'Electrical,' for instance—you will find a list of patents with numbers attached, and if you require information about any special instruments, such as 'generators,' you are obliged to read through the whole list and note down the numbers of the patents which you think are likely to interest you on a slip of paper which is generously provided for you. I enquired at the publishing office up to what date abstracts of electrical patents had been made, and was told there were not any later than 1876! The abstracts published in your paper every week are excellent, but, of course, are not indexed or arranged in any systematic way, which is obviously impossible in a weekly journal. Do you not think it is high time for engineers and patentees generally to combine and awaken these slumberers, compared with whom the Seven Sleepers were but as after-dinner dozers? I hope you will insert this letter, and also give your opinion upon this very important subject."

What's in a Name?—Mr. Chas. Heinrichs, who was formerly well known in London, is now a notorious character in New York. He has, at one fell swoop, sprung from comparative obscurity into being the best abused man in the States, and through his connection with the high tension current controversy, he has been given the high sounding title of "busybody Heinrichs." Evidently the advocates of 2,000 to 10,000 volts for electric lighting purposes do not love him.

No Dynamos, no Steam Engines!—We would much like to know whether Mr. Bridgman, who achieved such notoriety at the recent discussion amongst the members of the City Electric Lighting Committee, by his reference to a scheme for producing the light without the aid of engines and dynamos, alluded to the Perreur-Lloyd system. If so, we could possibly enlighten his colleagues as to the real nature of this venture.

A Courageous Telegraph Messenger.—At the Worthing Police Court, before the ordinary business commenced, the Chairman, Major Gaisford, publicly presented to a telegraph messenger, named Lucas, a parchment testimonial awarded him by the Royal Humane Society for saving the life of a boy, named Cartwright, nine years, the son of a gentleman living in the town. The boy slipped off a groine into 6 feet of water, and would have been drowned but for the promptitude displayed by Lucas, whom Major Gaisford complimented on his courage and presence of mind.

The Taunton Electric Lighting Company.—As will be seen elsewhere, the Taunton Company have decided to create 2,000 new shares at £5 each, necessitated by the increase in the demand for the light.

Electropathic Quackery.—We have been made the recipient of a letter which shows how a gentleman was mulcted in the sum of ten guineas for an electropathic belt warranted to cure his ailments. Unfortunately the guarantee was but a verbal one, and still more sad to relate the guileless patient derived no benefit from a prolonged and patient application of his purchase. The story is too lengthy to relate, but it is only one example amongst thousands which go to prove the truth of that famous dictum of the Claimant to the Tichborne estates, who philosophised somewhat as follows:—"Some people have brains and no money; others have money and no brains. Surely the people with money and no brains were made for those with brains and no money?" The Claimant's axiom is still in force, and in no quarter is it better shown than in the relations which exist between a certain section of the much-to-be-pitied British public and the gentry who vend the quack goods dubbed electropathic belts.

Cured by the Dynamo.—A cure was effected, so we are told, by the use of a dynamo a few days ago at Westgate-on-Sea. Mr. E. Brown, of Princess Terrace, Westgate, was fitting a false bottom to a grate, and while chipping it to make it fit, a very small splinter of iron flew off and struck the man in the eye. A well-known electrical engineer of Westgate (Mr. Storr) meeting the man, and hearing of the accident, took him to the dynamo, which was then running at his establishment. Brown placed his eye as close as possible to the machine, when it was found that the magnetic attraction was sufficiently intense to withdraw the splinter of iron from the eye, which was instantly relieved, and the man is now perfectly well and at work.

The Electro-Harmonic Society.—The second smoking concert of the season will take place to-night, for which a very excellent programme has been arranged. The vocal artistes are Messrs. T. W. Page, Arthur Thompson, Musgrove Tufnail, and Frederic Upton. The instrumental portion will be divided between Messrs. T. E. Gatehouse and Alfred Izard, who will perform on the violin and pianoforte respectively.

Incandescent Lamps.—We understand that an incandescent lamp of German manufacture is being tested in London, and report credits it with being about the equal of an Edison-Swan of the same voltage and candle-power. The chief recommendation of the new arrival appears to lie in the claim that the filament does not come within the scope of Edison's patents.

NEW COMPANIES REGISTERED.

Llanelly Electric Light and Power Company, Limited.—Capital £15,000 in £1 shares. Objects: To generate, produce, store, accumulate, and distribute electricity, electromotive force or other similar agency for public and private lighting, and for the supplying motive power or heating. Signatories (with 1 share each): J. C. Howell (electrical engineer), J. P. Evans, C. F. Clans, A. Burton (electrical engineer), Oliver Williams, A. Ingram, J. S. Griffiths. The signatories are to appoint the first directors. Qualification, £250 in shares. The company in general meeting will appoint remuneration. Registered 26th October by Waterlow and Sons, London Wall.

National Electric Supply Company, Limited.—Capital £100,000 in £5 shares. Objects: To produce and supply electricity or electrical current or force for light, heat, motive power, or for telegraphic, telephonic or other means of communication or locomotion. T. V. Wentworth, 78 shares, Bruce; C. V. Wentworth, 24 shares, Wentworth Castle, Barnsley; S. D. Waddy, Q.C., 54, Temple, 48 shares; *Dan Rylands, Barnsley, 120 shares; *C. H. Cobbold, M.E., Dodworth, 60 shares; *Thos. Robinson, Moor-Allerton, Leeds, 60 shares; *Walter Emmott (electrical engineer), Halifax, 60 shares. The signatories denoted by an asterisk are the first directors. Qualification, 50 shares, or £250 stock. Remuneration, £200 per annum to the chairman, and £100 per annum to each director. Registered office, 12, Coleman Street. Registered 28th September by S. Learoyd and James, 12, Coleman Street.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Corinthian Electro-Medical Battery Company, Limited.—The statutory return of this company is made up to the 2nd August. The nominal capital is £25,000 in £1 shares; 20,804 shares have been taken up, and of these 20,000 are considered fully paid. Upon 804 shares the full amount has been called, the calls paid amounting to £800, and unpaid to £4. Registered office, 1, Gate Street, Lincoln's Inn Fields.

Planet Electrical Engineering Company, Limited.—An agreement of 15th August between Roger Wm. Wallace, of 2, Harcourt Buildings, Temple, and Joseph Browne Martin, of Victoria Mansions, S.W. (the vendors) of one part, and the company of the other part, provides for the purchase by the company of the interest of the vendors in certain agreements relating to the purchase of certain provisional protection for arc lamps, electric governors, dynamo electric machines and motors, and for improvements in mechanical clutches for transmitting motive power. The purchase also includes the business of electrical engineers carried on by the vendors at Dacre Street, Westminster. The purchase consideration is £3,500 in fully paid shares.

Notting Hill Electric Lighting Company, Limited.—At an extraordinary general meeting of this company, held at 9, Austin Friars, on the 3rd October, a series of fresh regulations were submitted to the meeting, and were approved and adopted in substitution for the existing regulations, which are, therefore, annulled. The resolution was confirmed on the 18th, and duly filed on the 21st October.

The annual return of the company, made up to the 17th October, was filed on the 22nd October. The nominal capital is £100,000 in £10 shares; 141 shares have been taken up, and the full amount has been called and paid thereon.

Portsmouth and South Hants Electricity Supply Company, Limited.—At an extraordinary general meeting of this company, held at 13, High Street, Portsmouth, on the 27th September, a resolution was passed authorising the following article to be substituted for article 9 of the present articles, viz.:—"The founders' shares shall entitle the holders thereof to such dividends and other interest in the profits of the company as are defined by the articles of association, and in the event of the return of the capital to the members, or a distribution of assets, whether in a winding up or otherwise, the surplus assets remaining after a return of the whole of the capital paid up on all the shares of the company, shall belong, as to one moiety thereof, to the holders of the ordinary shares, and as to the other moiety to the holders of the founders' shares, and shall be divisible amongst the holders of each and such classes of shares respectively, *pro rata*, according to the number of shares held, and the amount called up and paid thereon, respectively, for the time being. In case any question shall at any time hereafter arise between the company, on the one hand, and the holders of the founders' shares, or any one of them, on the other, as to the amount of the net profits of the company during any period, the certificate of the auditors as to such amount shall be final and binding upon all parties." The resolution was confirmed on the 14th October, and was duly filed on the 23rd October.

The statutory return of the company, made up to the 11th Sept., was filed on the 25th Sept. The nominal capital is £50,000, divided into 9,900 ordinary and 100 founders' shares of £5 each. Forty-five ordinary shares have been taken up, and £2 per share has been called, the calls paid amounting to £70, and unpaid to £20.

Kensington and Knightsbridge Electric Lighting Company, Limited.—The registered office is now situate at the electric lighting station, Chapel Place, Brompton Road, S.W.

Kensington Court Electric Lighting Company, Limited.—The registered office is now situate at the electric lighting station, Chapel Place, Brompton Road, S.W.

CITY NOTES, REPORTS, MEETINGS, &c.

The Brazilian Submarine Telegraph Company, Limited.

THE directors submit the annexed accounts and balance sheet for the half-year ended 30th June, 1889.

The revenue for this period amounted to £113,083 6s. 10d., and the working expenses to £13,329 11s. 9d. After providing £12,880 for debenture interest and sinking funds, and £1,593 8s. 6d. for income tax, there remains a balance of £85,280 6s. 7d.; to this is added £20,828 17s. 2d. brought forward from 31st December last, making a total of £106,109 3s. 9d. A quarterly interim dividend amounting to £32,500 has been paid, and £45,000 transferred to the reserve fund, increasing that fund to £259,660 9s. 8d.

The directors now recommend the declaration of a final dividend of 1s. per share, making, with the interim dividends, a total dividend of 6 per cent. for the year, and also the payment of a bonus of 3s. per share, both free of income tax, which together will amount to £26,000, being a distribution in the aggregate of 7½ per cent. for the year ended 30th June, 1889, leaving a balance of £2,609 3s. 9d. to be carried forward.

On the 31st July last the sum of £14,509 was transferred to pay off the 145 bonds of the 1884 issue, drawn for redemption in April last. This repayment reduces the debenture debt to £159,500.

The new cable to the Cape of Good Hope *via* the West Coast of Africa was opened to the public on the 4th June last. Messages to and from South Africa now pass over this company's lines between St. Vincent and Europe under the arrangement referred to in the last report. The receipts from this traffic justify the expectation of a satisfactory return on the capital invested by this company in the shares of the African Direct Telegraph Company.

The various sections of the company's line are in good working order.

The Right Honourable Viscount Monck and the Duke de Loulé, retire by rotation at this meeting, and being eligible for re-election as directors, offer themselves accordingly.

The two auditors, Mr. Henry Dever and Mr. John Gane, also offer themselves for re-election.

Taunton Electric Lighting Company.

AN extraordinary meeting of the Taunton Electric Lighting Company was held on Monday evening at the Castle Hotel, for the purpose of passing a resolution to create 2,000 new shares of £5 each, necessitated by the increased demand of the electric light by consumers, to provide which new premises are being erected and new plant purchased. In the absence of the chairman of the company (Mr. W. H. Fowler), Mr. J. H. Bale (vice-chairman) presided.

The Chairman, in moving the first resolution, said: The circumstances which had given rise to the necessity of calling the meeting would be explained to them by their managing director, Mr. Massingham, and all he would do was to propose the following resolution:—"That the capital of the company be increased by creating 2,000 new shares of £5 each, and that the directors be empowered to offer, in the first instance, to the shareholders of the company willing to accept the same, and in proportion to their several holdings, and subject thereto to issue and allot in such other manner as the directors may think expedient, all or any of such new shares, at such time or times, and at any premium, and generally on such terms and conditions in all respects as the directors may determine."

Mr. H. G. Massingham, in seconding the adoption of the report, said he was extremely pleased that the finances of the company necessitated such a resolution being passed. It was four years ago since the electric light was introduced into Taunton. They had then only one dynamo. Now they possessed six dynamos, and their works would hold no more, so that at the present time they were obliged to refuse further customers. They had been in that position for some months now, and the directors had to choose between two alternatives—to refuse customers or increase their works. They had decided to adopt the latter alternative, and as their present works were not capable of extension, the directors had purchased a plot of land, which had been known as St. James's Vicarage, and upon that they were building an entirely new depôt, which when completed he thought would be a model depôt, and something worth showing those numerous deputations who, during the past three or four years, had visited Taunton from all parts of the United Kingdom. He found that the price at which the electric light was supplied in Taunton was lower than that charged in any other town in the United Kingdom, with the exception of Bath and Exeter, where it was the same. As far as he could ascertain it was lower than had been charged anywhere on the Continent or in America. In fact, he believed it was the lowest in price of any place in the world. The average price of the electric light in London was 100 per cent. more than was charged in Taunton, even in competition with those large companies with their enormous capital and greater power. He found, too, that in the case of the Eastbourne, Brighton, and Hastings Company the average charges were 200 per cent. more than they were charging in Taunton, so that there was no disguising the fact that Tauntonians were in a position to enjoy one of the greatest products of science at a price that no other community in this country could possibly command, and he sincerely hoped when they put down the new plant they should have a large acquisition of customers.

Mr. W. Potter supported the resolution, which was put to the meeting and carried unanimously.

The Indo-European Telegraph Company, Limited, has declared an interim dividend for the half-year ended June 30th, at the rate of 5 per cent. per annum, tax free, payable on the 1st of November.

TRAFFIC RECEIPTS.

The Western and Brazilian Telegraph Company, Limited. The traffic receipts for the week ending October 25th, 1889, after deducting the fifth of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited, were £2,739.

The Brazilian Submarine Telegraph Company, Limited. The receipts for the week ending October 18th, 1889, amounted to £4,477.

LONDON COUNTY COUNCIL.

ELECTRIC LIGHTING IN KENSINGTON.

AT the weekly meeting last Tuesday of the London County Council at the Guildhall (the Earl of Rosebery presiding), the Highways Committee reported that they had considered a notice, dated October 17th, 1889, given to the Council by the Kensington and Knightsbridge Electric Lighting Company, under the company's electric lighting order, 1889, of its intention to lay mains in Church Street, Kensington, and a service line at Hyde Park Gate (Registered No. 10). The committee had received a report from the engineer on the subject, and now recommended:—"That the Council do signify its approval of the works referred to in the notice of the Kensington and Knightsbridge Electric Lighting Company, subject to the condition that the straining-up and service boxes to be used shall be of the same size and description as those previously sanctioned by the Council."

The recommendation was approved.

PROPOSAL TO LIGHT WHITECHAPEL.

Mr. JOHN LLOYD had the following resolution on the agenda paper:—"That it be referred to the Highways Committee to consider and report on the desirability of the Council applying to Parliament for power to improve the condition of the Whitechapel district, and pending the production and adoption of some complete scheme for the purpose, to light the district with the electric light."

A COUNCILLOR asked the ruling of the chairman whether the motion was in order.

The CHAIRMAN: It is absolutely impossible for the Council to light the district with electric light as we have no power to do so.

Mr. LLOYD: I only propose that we should make an application to Parliament.

The CHAIRMAN: I think you propose that we should light the district, pending the application.

Mr. LLOYD: No.

The CHAIRMAN: Then the motion is in order.

Mr. LLOYD remarked that as the Council had no control over the police, and as the state of Whitechapel was most unsatisfactory, it had occurred to him that by having better lighting there they might do something to make the place safer than at present. As the West End and the City were going to be lighted with the electric current, he thought the Council ought to apply to Parliament for power to do something that might help to prevent further commission of crime. The cost of lighting the district would not be very much. The Council had a vacant piece of ground there whereon an electrical station could be erected.

Mr. MOORE seconded the motion.

Mr. SAMUEL considered the resolution [illegible] the most absurd which had been brought before the Council. The district of Whitechapel was, on the whole, well lighted. Of course there were some places where there was room for improvement. But such an attempt to interfere with the local authorities as was suggested would not only be ungracious but unnecessary.

The resolution was negatived almost unanimously.

SUBWAYS.

The discussion, deferred by the Council on October 22nd, as to conferring powers upon them respecting subways (the particulars of which were published in last week's ELECTRICAL REVIEW) was resumed.

Mr. A. H. HAGGIS (Chairman of the Highways Committee) stated that the object of the committee was two-fold—one was to have the power to make the subways and to charge for them, and the other was to amend the law with regard to the subways. It was most desirable that a system of subways should be laid under the main streets. At present there was an immense loss of money, and a great amount of inconvenience and trouble caused in pulling up streets by the gas and water companies in order to lay their mains. Great havoc had been made in the roads in past years by the gas and water companies, and it was very desirable that such a state of things should be done away with. For the purposes of their mains, and for repairs, the companies made excavations very frequently. He did not know whether the Council were aware of the extent to which this was done, and, therefore, he would give a few statistics respecting the openings which were made in some of the districts by the gas and water companies. In the district which he represented—that of St. Saviour, Southwark—in the past six years the openings made by the gas and water companies amounted to over 1,337 per annum, and the area of the openings reached nearly 24,000 superficial feet, about half of that being in the footway and about half in the roadway. Last year in St. George-the-Martyr, Southwark, 1,848 openings were made, and in Fulham last year there were 1,957 openings, and in Chelsea 2,906 openings were made. That showed the great extent of the excavations, and the consequent inconvenience to the public by the pulling up of the roads. The whole of the expense which it entailed might be saved and the public inconvenience avoided if subways were made as he suggested. At the present moment the various electric lighting companies were laying down mains in many thoroughfares, and for some months to come the streets would be disturbed by the works of those various companies. All that might be avoided if there had been subways under the streets. All that was asked was permission to make them at convenient times. They had no large scheme for making them at present, but would take the opportunity whenever it occurred. It might be asked why they did not leave the work to the local authorities to do at their own cost. With a few exceptions, however, all the existing subways had been made at the expense of the Metropolitan Board of Works, and as the Council would very soon have charge of the main roads of London, it was to be hoped that they would have those powers conferred upon them, for it would be in the interests of economy that they should take care that the roads were properly made, and not broken up as now by the various companies. If the subways were formed it was very desirable that they should be connected with each other and not disjointed. No doubt the cost of making them would be very large, and the committee felt that it ought not to be placed upon the ratepayers' shoulders, but that the companies should bear the cost of them as they would have the use of them when made. They could very well afford to pay for the convenience. The Council had eight subways under its control, altogether of about four miles in length, and they cost the old ratepayers about £50,000 to construct. Then there was the cost of maintenance, which together brought the cost up to about £90,000. Most of them had openings into all the houses, so that the roads would not have to be broken up when connections or repairs were undertaken. Over three of them the Council had no statutory powers at all. Subways had been made in Northumberland Avenue, Charing Cross Road and Shaftesbury Avenue, but although the ratepayers money had been used in constructing them, the Council could not compel the companies to use them, and if they used them to pay for them. With respect to the other five, they had powers over the companies as to new pipes laid in the subways, but they had no power to make the companies transfer old pipes. Indeed, it was a fact that the subway in Southwark Street had never been used at all. It was very desirable, therefore, to have powers to compel the companies to transfer their pipes to the subways, and in that case it was proposed to let them rent free for a certain number of years in order to compensate the companies for the initial expenditure. When the electric lighting companies were before Parliament the Council obtained a clause inserted in all the Acts to cause them to put their mains into subways, and for the Council to charge for their use. Matters, therefore, in that respect, were on a sure footing.

The recommendations of the committee were then agreed to without discussion.

ELECTRICAL ENGINEERING AT THE EXHIBITION.

ARTIZANS' OFFICIAL REPORTS.

THE reports of the 75 artizans delegates, selected by the Mansion House Committee to visit the Paris Universal Exhibition, have just been issued in a volume of nearly 700 pages. In these reports the individuality of the writers has been strictly maintained, and are presented from the workman's standpoint.

The following is the report of Mr. T. M. SERGEANT, on electrical engineering:—

"After the glowing accounts of the Paris Exhibition which have appeared in nearly every periodical, some taking a general view of the Exhibition, and others describing particular departments, it is unnecessary for me to exceed the bounds of my trade, and, therefore, I beg to restrict my few remarks to by no means the least important part of the exhibition, viz., that of electrical engineering, particularly with regard to the construction of accumulators.

"I was greatly disappointed at the total absence of any new system of accumulators. This, I think, is much to be deplored, as I know of one great improvement that was not exhibited. Seeing the great importance and enormous demand for a perfect accumulator with plates that do not disintegrate, I quite expected to have a large number to report upon.

"*The Faure-Sellon-Volckmar E.P.S. System.*—This accumulator is well known, and has been for some years. The elements are composed of cast lead grids of small square holes, each hole having a raised central edge to all four sides; this raised edge is for the purpose of affording a strong holding for the material, which is spread into the small square holes of grid in a stiff paste, then pressed and stood in racks to dry and set hard; when they have stood some days under these conditions, they are then arranged in boxes in size and number of plate to meet requirements.

"The material used for the negative plate is litharge, mixed with a certain proportion of sulphuric acid and water, the positive plate being filled with red lead. The plates are arranged in boxes, the negatives on one side of the box and the positives on the other. The negatives are all coupled together, and the positives also. Sufficient electrolyte of sulphuric acid, and a certain proportion of water, is poured into boxes in quantity sufficient to cover the plates; they are then ready for forming, by the positive plates being coupled to the positive pole of the dynamo, and the negative plates to the negative of dynamo, the negatives becoming spongy metallic lead, the positives becoming peroxide of lead. When this change is complete, they should be discharged; but not below a certain degree, and then recharged until they have arrived at their full capacity.

"*The Reynier System.*—The plates of this accumulator are differently manufactured; instead of grids, the plates are of thin sheet lead closely corrugated, then burnt into an outer frame of thicker lead, combining strength and conducting pieces; the peroxide and spongy lead is then formed on the plates, the corrugated plates offering a much larger surface than the grid, but not so lasting, as the thin lead sheet soon becomes peroxidised through and falls to pieces.

"*The Paul Gadot System.*—This form differs little from other lead accumulators, the lead frame or grid having a lesser number of square holes, and instead of the raised central edge spoken of in the E.P.S., the four sides of each square hole are concave instead of convex, thereby giving a greater hold for the material, and lessening the danger of the material falling out; this, no doubt, is an improvement as far as strength is concerned, but is not so good for conductivity, the plate being divided into square holes of larger size, thus giving less conductivity to the material.

"Information regarding wages is very difficult to obtain, the industry being so small and the processed manner of manufacture being kept a secret. As many parts of accumulators do not require skilled labour, the usual French tariff for unskilled labour is adopted.

"The work is very unhealthy, as the material used in litharge, which readily enters the pores of the skin and is also taken into the lungs. I could not obtain any information as to what arrangements are made to lessen the danger, but, from what I saw, am inclined to think (if any) they are very bad and incomplete."

TELEGRAPH CONSTRUCTION.

Mr. W. G. DARKE (of the General Post Office) thus reported:—

"I beg to submit the following report of my visit as a delegate to the Paris Exhibition. The welcome and hospitality which I everywhere received during my stay altogether exceeded what I could have anticipated. I regret to say that I was not successful in obtaining permission to visit the factories and workshops, or I might have been able to furnish a more complete report; yet I have done my best, seeing that I was obliged to study most things through glass cases, and was not allowed to touch or handle anything.

"*A Table of Conductor Joints, Exhibited by J. Lapondite* (*Brevité*), 9, *Rue St. Sebastien.*—These joints are a new method, and are intended for telegraph and telephone circuits. A long spiral twist is made with the superfluous ends uncut, a small metal tube about 3 inches long, with the diameter sufficiently large for the tube to slip over the spiral twist. This tube is divided half way with a male and female coupling; each section of tube has a small hole drilled through the external surface at one-eighth of an inch from the opposite end of the coupling centre. Previous to the twist being formed, the whole tube is pushed over one of the ends to be jointed, and when the twist is made, the divided tube is manipulated so as to slip the ends of the conductor through the drilled holes in the cylinder. The two conductor ends are drawn through so as to close the coupling of the tube. They are then clipped off, and a permanent soldering connection is made at these points, and also at the coupling centre. It should be noticed that the conductors shown on the tablet do not exceed the No. 10 S.W.G.; and the metal is probably soft copper wire.

"Other samples are shown with the superfluous conductor twisted spirally outside the tube without being soldered, probably for temporary connections.

"*Submarine and Electric Light Cables. Menier, 7, Rue du Théatre.*—These cables are of a different design and finish to those of the English make. They are, however, very good, and there are a large number of various samples shown. A set of seven gutta-percha covered joints in a cable, showing the several coatings, are exhibited. Each conductor is filed on the bevel, and the two ends are brazed together; the gutta-percha on each side is drawn over and worked together in the ordinary way, and the external coating is on the obsolete seam system. I visited this maker's factory, but was only allowed to view the electrical testing apparatus in the testing room, which was very nicely arranged with excellent modern instruments, and a storeroom of insulated wire; but the visit was quickly cut short by the manager's haste, much to my disappointment.

"*Submarine Telephone and Electric Light Cables.*—*The I. R. and G. P. Co., Silvertown.*—The exhibits of these extensive manufacturers are of a very high order. Their tables of samples are of a very fine quality, both in design and finish, in both light and high insulation. Their glass case contains some very fine samples of gutta-percha and cotton-covereed leads, very durable gutta-percha, hemp plaited prepared leads, excellent quality lead-covered leads, and a number of fine samples of silk flexible leads; also India-rubber, cotton-covered and paraffined leads, and several samples of gutta-percha in its crude form, together with manufactured tissue of fine quality.

"*Uncoated Telegraph, Telephone and Coil Wire. Usines Métallurgiques de Boisthovel et Aube* (*Orme*) *et Filleures* (*Eure*).—This collection is the finest quality I have seen. A very peculiar sample is labelled buivre arsenical, 10 per cent., 2', arsenic, No. 60 cc. The characteristic of this wire is its hair-like fineness, resembling human hair of a rich auburn colour. There are also on view some very fine samples of metal wire, of a grey colour, and copper wire of various gauges, several of which are labelled buivre conductibilite maxima, longues pièces, 5 mm. Several other samples of wire are labelled Fil Téléphonique Plombe wire; Filétamé. Lignes Téléphoniques 80 Kos, 2 mm., condte. 34 per cent.; and bronze wire of various gauges, used for telegraph line, &c.

"*Electrical Measuring Instruments.*—Elliot Brothers, of London, are exhibiting a grand display of their fine instruments, so much used in electrical testing; a very large assortment is on view in their fine circular case.

"*Batteries, Leclanché.*—This maker's collection of cells and batteries, which are so noted, is very good.

"*Telephone and Bell Leads; Henry Geoffroy, 54, Rue de J, E. 2, Mitage.*—This maker's collection of samples of coil wire, both covered and uncovered, are very good indeed. Some very fine silk covered telephone and bell leads are of beautiful design and finish.

"*Electrical Testing Apparatus: Ecole Municipale Diderot d'Apprentissage.*—In viewing these exhibits I was struck with the extraordinary skill of these youths, who have only received but a few years' training. This speaks well for the excellence of the system adopted, which was fully explained by the respected manager in good English. I was also struck with the careful manner in which the lad is selected for the particular trade for which he has had an aptitude, and the gentle leading along, step by step, until he enters the advanced class; the excellence of the quality and quantity of the dietary, the large, clean, airy dining room, and the fine recreation ground, and the alternate system of work and recreation, which appears to be a leading feature, and which is so necessary for the welfare of the lads under training. They are seen to go leasurely and pleasantly about their work, and to understand thoroughly every branch they are engaged upon. Among their various exhibits is an electrical measuring apparatus, the metre bridge, which is very nicely made. I must not pass over the girl's technical school without adding my testimony to the extraordinary efficiency of the training they receive, which is even more perfect, if possible, than that of the boys; everything that can be done for the comfort and happiness of the girls, whilst under training in laundry work, dressmaking, stay making, artificial flower making, &c., is done with great judgment.

"*Electrical Testing Apparatus. J. Carpentier, 20, Rue Delambre.*—The collection of this maker is very good. He exhibits several reflecting galvanometers, bridge sets, rheostats, &c. But his metre bridge is a grand instrument; the vernier can be read quite distinctly with the naked eye, and its travelling arrangements is all that could be desired. It is the very best of its kind, so far as I could see, in the exhibition.

"*Porous Cells. Thierre, 47, Rue Vieille du Temple.*—This maker's collection of porous cells of various sizes, from the smallest to the largest possible practical size, round and flat shapes, for excellence of manufacture are unequalled. A very good collection of porcelain insulators, of various shapes and sizes, is also exhibited.

"*The Construction of Telephone Circuits. Edison's Telephone Company.*—This firm exhibits a very fine collection of materials, apparatus, and tools, their cables and leads being all insulated with India-rubber. Some very fine samples of pure India-rubber in its manufactured form are shown. They also exhibit a model of metallic telephone circuits, erected upon poles, all the wires running straight. The method of twisting around each other is carried out at from four to five spans of wire, with a short lead making the necessary diagonal formation. This is a more simple, and equally effective arrangement, than erecting the wires so as to make them revolve around each other. Their collection of insulators is very good, many new designs being shown.

"*Electrical Testing Apparatus. Latimer Clark, Muirhead & Co.*—These exhibits are very good. There is a large assortment of every apparatus used in electrical testing.

"*Telephone Lead-Covered Cables. Fathern's Patent.*—These exhibits are very good. The method of jointing is also very good. A piece of lead tubing is pushed over one of the ends to be jointed; the conductor joint is made, the piece of tube is drawn over, and the lower end sealed with solder, the upper end is filled in with some insulating composition, and then permanently sealed with solder. The section of a joint is shown, which looks very well. A T-joint is also shown, but this is made with sheet lead, and the sides sealed with solder.

"*Fine Metal Wire. C. H. Goguel, Clontbeliard.*—This collection is very remarkable on account of the extreme fineness of the wire and the various beautiful colours of the different samples labelled 'Fils de Cuivre Conducteurs d'Electricité.' There are 11 coils, and they are numbered (not consecutively) from 20 to 38 and from 20,000 to 125,000 metres AuK°.

"*Galvanised Iron Wire, Société Anonyme de Commetitry pour Chambait.*—This collection of samples is excellent. They are labelled 'Fil galvanisé.'

No. 1.	Poids	18 k.	long	2,217 m.
No. 3.	"	16 k.	"	4,104 m.
No. 5.	"	22 k.	"	3,960 m.
No. 13.	Fil étamé	27 k.	"	2,125 m., &c.

"*Sir William Thomson's Siphon Recorder. The Eastern Telegraph Company.*—The exhibits of this company include a patent recorder joined up in full working circuit. The working operation of this beautiful instrument was fully explained to me by the obliging clerk in charge.

"*Electrical Testing Instruments. Maison Breguet, 39, Quai de l'Horloge.*—This firm exhibits a very fine collection of electrical testing instruments, keys, switches, condensers, &c. Their tangent galvanometer is a speciality, with three circuits, including shunt. This is a very nice instrument, and, so far as I could see, the only one of its kind in the Fxhibition.

"*Electric Light Construction in Paris.*—This branch of electricity is now being extensively carried out. A trench is made along the footway about 3 feet deep, a subway about 2 feet wide by 1 foot deep is built, with concrete slabs, which are cemented at the joints. On the bottom, at right angles, are fixed the porcelain insulators which carry the bare main lines of multiple strand copper wire, the latter exceeding 2 inches in diameter; from the large mains the insulated leads of two different kinds of rubber core branch off to the lamps. The mode of jointing the mains is accomplished by sawing away three of the seven multiples about 4 inches from each end. Each of the ends are then tinned, *i.e.*, dipped in hot solder, and when placed together are fixed permanently in a split iron tube about 8 inches long; this tube is held in position by six bolts and nuts, three on each side; when sufficient tension is maintained hot solder is poured through a small hole until all the vacant space is filled in; finally, hot solder is poured on the parts where the ends of the tube meet the main; this is finished off with a wiper, as would be done in a plumbing process.

"*The Soirée at the Hôtel de Ville.*—The pleasurable evening spent in this most beautiful of buildings, lighted in the interior with 5,000 incandescent lamps of 15 C.P. each, in chandelier form, is worthy of record; nothing could exceed the splendour of this display of electricity, and the magnificent architectural surroundings of the building itself."

Mr. Darke concludes his report by an illustrated description of the mode of jointing gutta-percha covered wire.

THE APPLICATION OF SIEMENS'S FIVE-LEAD SYSTEM.

[FROM A CORRESPONDENT.]

The municipal authorities of Königsberg, in Prussia, in conjunction with the representatives of the citizens, resolved this spring to carry out, at their own expense, an electric central station for the town, which was calculated for a supply of 30,000 16-candle glow lamps, though arrangements are to be made at first for 8,000 lamps. The entire installation, as it is now about to be executed, merits the attention of the entire electro-technical world, and of all persons interested. We will, therefore, briefly give the chief points which will be brought forward in executing the installation. The current will be supplied from four groups of slow speed dynamos, arranged in series, and connected directly with the steam engine. Between these dynamos and the conducting net there is placed a battery of accumulators of suitable capacity and tension. For the net of conductors, in consequence of the extended lines of streets to be traversed, the five-lead system has been selected. The leads are not cables, as has hitherto been customary, but uncovered rods of copper, resting on insulators of porcelain, and laid in channels of cement. These channels will be mostly carried underneath the flags of the footway. The distribution of the current takes place so that each of the four successive current circuits formed by the five-lead system shows a working tension of 110 volts. The execution of the entire electrical installation, original and in many respects interesting, is entrusted to the firm Naglo Brothers, of Berlin, who will use for storing up electric energy "Tudor" accumulators made by the firm Müller and Einbeck, of Hagen.

The above-mentioned Siemens's "five-lead system" has not yet been practically applied in any electrical installation. But the firm Siemens and Halske is executing two extensive installations on this system, one at Vienna and the other at Trient. These two installations will be shortly in operation, and as many doubts have been raised concerning the practicability of this system, which is a further development of the three-lead system, and is hence regarded as too complicated, the inauguration of the Siemens's installations is awaited in technical circles with no little interest.

THE NEW FRENCH TELEPHONE LEGISLATION.

The *Journal Officiel* has just published two decrees relative to telephonic communications. The first has for its object the fixing of the rate of payment for telephonic conversations on the urban and interurban lines, when they are not subject to the *régime* of subscription. The following is the text of the first decree:—Article 1.—The amount to be paid on entering a public telephone cabin to obtain communication with an urban line is fixed at 50 c. at Paris, and at 25 c. in all the other towns of France. Article 2.—The elementary amount to be paid for an interurban telephone conversation is fixed at 50 c. per 100 kilometres or fraction of 100 kilometres of distance between the points joined by the telephone line. The distance is calculated according to the real route of each line. Article 3.—For the application of the amounts above indicated the normal duration of the conversation is fixed at five minutes. This duration may be reduced to three minutes on lines, and under determined conditions by Ministerial warrant. If the needs of the service require it, a conversation may not be prolonged beyond the double duration of its normal duration. Article 4.—All dispositions contrary to the present decree are abrogated, save those of the decree of December 28th, 1886, fixing the amount to be collected for telephonic communications exchanged between Paris and Brussels. Article 5.—The amounts fixed above will be applicable on and from November 1st.

It may be mentioned that, according to anterior decrees, the amount to be paid was fixed at 1 franc between Paris and Reims, Paris and Havre, Paris and Rouen, and Paris and Lille, which are all more than 100 kilometres distant. The amount payable for communications exchanged over the Paris-Brussels line (340 kilometres) was fixed at three francs, that for communications between Paris and Lyons (531 kilometres) was fixed at two francs, and that for communications between Paris and Marseilles (880 kilometres) at three francs.

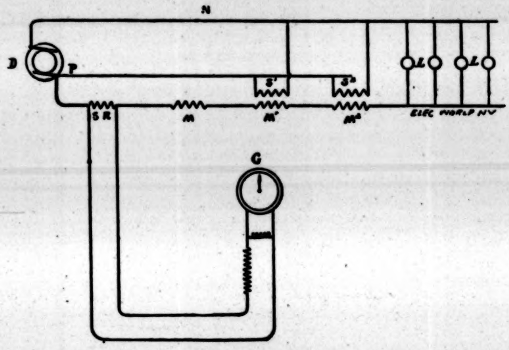
The object of the second decree is to authorise and regulate the telephonic translation of telegrams. It runs as follows: Article 1.—The subscribers to the urban telephone lines may send and receive telegrams by the line by which they are connected with those lines. The transmission of these telegrams is carried out gratuitously, with the exception hereafter noted; but it is subordinated to the prior deposit of a sum destined to guarantee the payment of the telegraphic amount. In towns having a subterranean line, the subscriber who proposes to make use of the foregoing disposition has to deposit annually, and in advance, a sum of 50 francs. Article 2.—Localities other than the principal places of a canton may be joined to a telegraph office by means of a telephone wire. This wire, and the telephone office which serve it, are established with the participation of the communes interested. The part to be contributed by these communes to the expenses of the first establishment is fixed at 100 francs per kilometre of new line to be constructed, or at 50 francs per kilometre of wire to be established on already existing supports, and at 300 francs for the apparatus and installation of the telephone post. Article 3.—In localities possessing a postal receipt office, the telephone service is confided to the receiver. In all the others, the manager of the telephone offices and his deputy are nominated by the *maire* after having been agreed to by the departmental director. They may be replaced on the demand of the Administration. They benefit on the transmission of telegrams by the same allowances as the managers of municipal telegraph offices. They take the same professional oath. Article 4.—Every person may send and receive telegrams by a municipal telephone line. The transmission of these telegrams is carried out gratuitously, but it is subordinated to the payment of the telegraphic amount. The payment of this amount is effected by the manager of the telephone office. If this manager be not at the same time a postal receiver, his receipts and his expenses are included in the accounts of the telegraph office with which it communicates. Article 5.—Every telegram intended to be distributed by a municipal telephone office is subject of the expenses of special messenger, unless the municipality may have made arrangements for gratuitous distribution. Article 6.—A telegram may only be telephoned, either by an urban line or by a municipal line, if it be written in French, in clear language, and if its text does not exceed 50 words.

Hitherto, this distribution has been effected gratuitously on the State lines; but the General Telephone Company only authorised it on its lines on payment of a premium on the subscription of 50 francs. Now that the State works directly all the urban lines, it suppresses this duality of régime. Still, one exception has been admitted, as has been seen. It has reference to towns which have a subterranean line. Its object is to prevent crowding in places where the space reserved for the wires is limited by the canalisation, the line of which they must follow.

Shocking Death of a Telephone Employé.—An inquest was held October 25th at Ellesmere Park, on the body of Thomas Farrington, an *employé* of the National Telephone Company, from Warrington, who met with a shocking death. While engaged erecting telephone poles, he fell on some rails, upon which he was impaled with fatal result.

THE PARIS METER COMPETITION.

THE City of Paris some time ago commenced the construction of a central electric light station, and in anticipation of furnishing current to customers, was desirous of obtaining a good electric meter. For that purpose a prize competition was opened, in which any one was allowed to enter a meter. A prize was offered for the best. These meters are now being tested at the Hotel de Ville, in the office of M. Chretien, the chief of the City Electrical Department. No less than 23 different meters of all varieties are being tested, and as the test is still going on, no definite information as to the results can, of course, be given. Among the meters there are two American meters; the Edison, which, however, is not entered in competition, but merely for the purpose of test, and the Geyer-Bristol meter. In a test of this kind, it is absolutely necessary to have all the conditions exactly alike for each meter; for that purpose they are all connected in series, so that there can be no question of the same current passing through each instrument. The testing arrangement is shown diagrammatically in the accompanying sketch (from the Paris correspondence of the *Electrical World*). Here, it will be noted, the various meters, M, M^1 and M^2, are connected up in series. As most of the meters are watt-hour meters, in which one coil carries the main current, and a second, a high resistance shunt, measures the potential, an arrangement has been effected by which the potential furnished to the potential or shunt coil of the various instruments is the same. It is evident that if these coils were connected across the line directly, the difference of potential measured at each point would vary, on account of the drop in the line wire. To avoid this a potential wire is connected directly to the dynamo brush at the point, P, and run independently to the various instruments, so that the shunt coils, as, for example, S^1 and S^2, have practically the same potential, the drop in the line, N, which is a heavy wire, being negligible.



The method of test employed is the well-known fall of potential arrangement. A standard resistance, S, R, is placed in the main circuit, and the difference of potential at its terminals is measured by means of a Deprez-d'Arsonval galvanometer. The standard resistance, a heavy German silver coil, is very accurately calibrated by Carpentier, and the standard cell employed is the form devised by Fleeming Jenkin, in which the densities of both the copper sulphate and the zinc sulphate are at 1·20, which gives an E.M.F. of 1·106 volt. The testing arrangements are very simple, and all measurements can be easily controlled.

The Institution of Electrical Engineers.—It is said the following distinguished gentlemen have accepted invitations to the Institution dinner on the 4th:—The Marquis of Salisbury, the Astronomer Royal, the Hydrographer to the Admiralty; Mr. Courtenay Boyle and Major Marindin, R.E., Board of Trade; Dr. W. Anderson, the Presidents of the Royal Society, the Physical Society, the Institution of Civil Engineers, the Iron and Steel Institute.

INSULATION MEASUREMENT IN CENTRAL STATIONS.

ALL electricians, writes M. Jacquin in *L'Electricien*, know what disastrous results follow an interruption in the supply of electric lighting from a central station. It is therefore necessary to prevent, as far as possible, the occurrence of such accidents, which always throw a certain amount of discredit upon the electric light.

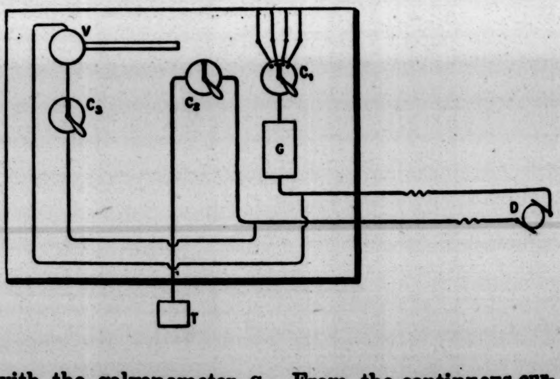
Now, nine times out of ten, these stoppages are due to a short-circuit, or a defect of insulation in the canalisation. In order to avoid them, the best and safest plan is to employ cables that are thoroughly well insulated, and to test them upon delivery; and, above all, after they are laid.

But the best cables may be affected, after having been laid, by various circumstances. It happens that, when least expected, a short circuit is produced in the line, plunging into darkness an entire district. We have found by experiment that these defects are only apparently spontaneous, and that in reality they do not occur suddenly. They manifest themselves at first by a slight diminution of insulation, which grows more and more decided, until it is sufficient to produce an accident. Consequently, if we take care to measure (we say measure, and not merely ascertain roughly) the insulation of each circuit, not from time to time, but *every day*, we shall easily discover this diminution in the insulation, and the defect can be sought out and remedied before it becomes dangerous.

All engineers agree in demanding that measurements of insulation should be taken frequently; but they do not go so far as asking for daily tests. We believe that there are very few central stations where the insulation of the different systems is measured every day. The reason of this is very simple. The insulation resistances are often very high, necessitating an apparatus of great sensibility; moreover, in a central station, laboratory apparatus cannot be used. In an industrial electrical works it is not practicable to employ a powerful battery, as it would require too much attention, or a mirror galvanometer and scale, as the installation is too complicated, and apt to get out of order. What we require is a galvanometer that can be fixed upon the table of distribution like a voltmeter.

The Municipal Works supplying the *Halles* being a model station, we have thought it desirable that the distribution board supplied by the Ferranti Company should allow of the insulation of the system being constantly tested by the engineers of the city. This is the method that we have adopted.

To this board are added three commutators, C_1, C_2, and C_3, and a galvanometer, G. The commutator, C_1 (fig. 1), enables any one of the lines to be connected with the galvanometer, G. From the continuous current exciting dynamo, D, proceed two wires, one of which goes to the galvanometer, G, and the other to earth, passing through the interrupter, C_2. Finally, a commutator, C_3, enables us to measure the electromotive force of the dynamo with one of the voltmeters, V, that serve for the ordinary working of the circuits.



The trials are made every evening, when the machines are started, before the circuits are supplied. The commutators, C_2 and C_3, are closed, and the galvanometer is connected with each of the lines in succession by means of the commutator, C_1. The deviation, α, of the galvanometer are taken, and the number of volts, E, furnished by the dynamo, D. The insulation resistances, ρ, are given by the formula :

$$\rho = \frac{K E}{\alpha},$$

K being the constant of the galvanometer. The operation is very simple, as is evident. The exciter giving a tension of about 100 volts, the insulation is measured at a potential sufficiently high to obtain an exact result. When a continuous current station is in question the dynamo, D, is a dynamo belonging to the service, instead of an exciter. The insulation is then measured at the potential of distribution, which is always preferable, but this condition cannot evidently be realised with circuits at 2,000 volts.

It still remained for us to find a galvanometer of sufficient sensibility, and one that could be placed upon the table. The voltmeter, which is sometimes used for insulation measurements for industrial purposes, was far from having the sensibility required. The Deprez-d'Arsonval dial galvanometer was not even sufficient, because the system being worked by alternating currents, the insulation of the primary line only is measured. After a long discussion on the matter with the engineers of the firm of Carpentier, we resolved to employ a Deprez-d'Arsonval microscope galvanometer of a type suited to our purpose. This is an ordinary but more compact Deprez-d'Arsonval galvanometer, enclosed in a wooden box. On the side of the box is a window with a cross wire, and on the front of the box is placed a microscope. The suspended mirror, instead of being concave, has a plane surface, and gives in the microscope a reflection of the wire. This apparatus is fixed upon the distribution board, and takes up very little room. The measurement is made by a simple reading of the microscope, and very easily, the galvanometer being aperiodic. Although at first it may seem singular to employ a microscope in a central station, this apparatus is certainly very practical and much more convenient to use than an electro-dynamometer, which instrument is in general use in electrical works. All we wanted was to think of it.

The microscope galvanometer possesses the same sensibility as the Deprez-d'Arsonval scale galvanometer —*i.e.*, it gives from two to three divisions per microampère. The electromotive force employed being about 100 volts, we can measure with this instrument an insulation resistance of 100 megohms. When the insulation is less, the galvanometer is shunted so as to bring the deviation within visible limits.

In continuous current stations there is no objection to the measurements being taken by this method during the service. Neither is there any reason why the insulation of circuits traversed by alternating currents should not be measured. But in this case, in order to preserve the galvanometer from accident, it is better to introduce into the circuit, as M. R. V. Picou suggested to the Société Internationale des Electriciens,* a bobbin with great self-induction, such as two primary circuits of transformers in series. But this is a complication that may be avoided by taking the measurement every evening, before the current of the dynamos is sent into the circuits.

We think we have now shown that it is possible, from an industrial point of view, to instal in a central station apparatus enabling the measurement of the insulation of the system to be taken daily. It is highly desirable that all electrical works should possess an installation of this nature, which would certainly prevent many an accident.

ELECTRICITY IN MINING OPERATIONS.

AT the recent meeting of the Mining and Metallurgical Congress, held in Paris, an interesting communication on the above subject was made by M. Chalon, C.E. After pointing out the various purposes for which electricity could be employed in mining operations, the author stated that the oldest application of electrical energy in mining industries was in the firing of blasts. When powder is employed as priming for the ignition of shots, it is hardly possible to fire more than one shot at the same time; but when electric primers are used, many shots can be fired simultaneously. Coming to the question of cost, M. Chalon estimates that it is much cheaper to employ electricity for firing than by the use of fuses. Taking, for instance, the sinking of a shaft 540 yards, he estimates the cost as follows :—

Cost of material and magneto machine for four simultaneous blasts, in sets of 6, 8 or 9 ...	£3	4	0
540 yards of double conductor, insulated with gutta-percha and cotton	3	4	0
Cost of erection and sundries	1	0	0
Total	£7	8	0

In a large mine as many as from 4,000 to 5,000 blasts are fired per annum. With the above apparatus, and taking the number of shots fired annually as 4,000, the cost for each firing amounts to ·44d. At this rate the author considers that the initial outlay for the wires would be saved in one year. When powder is used, the cost of firing comes out as follows :—

Simple primer for a spark with 40 inches of double conducting wire	1d.
Iron coupling wire covered with cotton, and 5 feet long. The loss from a series of explosions would not exceed 5 per cent.......	·037d.
Total	1·037d.

When dynamite is employed, the expenses would be :—

Primer with detonator containing ·75 grammes of fulminate, and a double conductor 40 inches long	1·50 d.
Coupling wire, with loss of 5 per cent., as before	·037
Total	1·537d.

From the above figures it will be seen that when electrical energy is used as the means of igniting blasts, the cost per firing amounts to ·44d., as compared with 1·037d. for powder and 1·537d. for dynamite.

M. Chalon next drew attention to the electric lighting of mines, and referred to the various kinds of safety lamps in and out of use. Turning to the Schanschieff and Friedlander lamps with primary batteries, and the Swan, Pitkin and Higson lamps with storage batteries, he stated that these lamps had the disadvantages of giving no indication of the condition of the surrounding atmosphere. Consequently, it was always necessary to employ in conjunction with them either a Davey lamp or a fire damp detector. Prof. Silvanus Thompson's recommendations regarding primary battery lamps for miners were next considered, after which reference was made to signalling. In conclusion, the author gave details regarding the employment of electrical energy for power purposes in this country and in America.

The figures given by M. Chalon regarding the comparative cost of firing by electricity, powder and dynamite are interesting, more especially as it is now a long time since similar figures were brought forward ; but we are afraid that he has been rather too sanguine concerning the cost of electricity. Of course, we do not wish to deprecate his estimate for the number of shots fired annually, but it is, as he states, only in large mines that 4,000 shots would be ignited in a year, so that in other mines the expenses would be greater.

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* See *Bulletin de la Société Internationale des Electriciens*, 1888, p. 409.

LONG-DISTANCE LIGHTING.

THE lighting of Ottawa, Ill., shows a remarkable example of pluck and energy. Owing to the convenience of water-power which reduced the operating expenses to a minimum figure, the idea of using an expensive steam plant was abandoned, and the company went eight miles east to the town of Marseilles, where ample water-power was secured, and there located the station. The station house having been located, the work of construction was then pushed, and great care taken to have both pole line and house circuits first class in every respect. For the trunk lines only a No. 8 American gauge copper wire was used, insulated with waterproof covering, although the first lamp reached was placed in Ottawa, some eight miles distant from the station. Altogether over 45 miles of circuits have been strung, including some 12 miles of No. 11 insulated copper wire. The distance along the railway following the river is 5 miles from Seneca to Marseilles, 7 to Ottawa, and 10 to Utica.

That the public spirited citizens of Ottawa appreciated the pluck exhibited in carrying the enterprise through to a successful issue is shown by the fact that the first dynamo is now carrying a full load, contracts having been secured for more than 100 15-C.P. lamps, 150 20-C.P., 300 30-C.P., and about 30 of large sizes, ranging to 100 C.P. In addition to this number the company is operating in the town of Marseilles over 100 lamps, and will shortly have 30 more in use for street lighting, and circuits are now being carried into the town of Seneca, some five miles to the east. The important features of this installation are (1) the great length of circuits, seldom, if ever, equalled in incandescent lighting; (2) the great area covered; (3) the comparatively slight investment for copper wire, being the least important part of the total cost of the installation, and (4) the fact that the lights furthest from the station are reported to burn as brightly as lamps placed near the dynamos, all of which tends to indicate both the flexibility of the Heisler system and its adaptation for long-distance lighting under circumstances that are often of the most disadvantageous and disheartening character. Barnet should now be in luck's way.

CONTINENTAL NOTES.

THE Special Committee appointed to enquire into the lighting of Brussels by electricity has expressed its wish that M. Rysselberghe should be authorised to experiment with his system, in the way of trial, on a space to be indicated to him. A second proposition of the electrical committee was to make an appeal to three of the companies whose tenders appeared to it to include the greatest advantages and guarantees—a Liége company and two German companies—with a view to get them to come to an agreement as to the cost of electric lighting. The Communal Council has yet to consider these propositions.

The permission granted in 1862 to introduce into Russia, free of entry dues, cables intended for the Russian Government telegraphs has been suppressed.

A few nights since, about half-past nine, a curious sight was witnessed at the Eiffel Tower. A large flock of larks, which was passing over Paris, attracted by the electric light in the *phare*, threw itself in a compact mass on the windows of M. Eiffel's apartments. With their well-known obstinacy, the poor birds struck themselves furiously against the glasses of the *phare*, and fell stupefied all round. The man in charge of the light was enabled to capture a large number. The next morning the gardeners employed in the Exhibition found a quantity of the birds in the small lakes at the foot of the Eiffel Tower.

M. Marcel Deprez has just made an important communication on the subject of the transmission of power to long distances by electricity. In the first place, he recalls the experiments made at Creil in 1886, which demonstrated that the principle of the problem had been found. Indeed, with a 125 horse-power engine placed at Creil, 85 horse-power was obtained at Paris. Unfortunately a wire broke during the experiment, which, however, was much discussed. It was not practical. M. Deprez then studied the method of making his machines more useful, and he thought he had arrived at a practical result at Bourganeuf, where his electrical machinery worked several months without accident. The generating machinery is placed at the St. Martin falls, about 14 kilometres from Bourganeuf. These falls are 31 metres high, the turbines furnish 130 horse-power, and revolve at a speed of 150 revolutions per minute. The machines are of 100 horse-power; the line is composed of two bronze wires of 5 millimetres, supported by fir posts. The receiving machine is identical with the generator; it is used with a certain number of accumulators. M. Deprez, in his communication, enters into details on the working of these machines. There are two for the production of light; but one is sufficient to ensure the service; it gives a daily yield of 50 per cent. in light, a yield which might be raised to 60 per cent. Communication is kept up between the stations by telegraph signals, which are more serviceable than telephones. Two persons are sufficient to ensure the working of the machines. Numerous lightning conductors protect the installation and the staff; and the accumulators, which number sixty, are charged every day. The work produced by the machines is absolutely regular, and the light is steady. The accumulaters had only been used twice, when a machine was disabled after a storm. M. Marcel Deprez concludes by saying that the new machinery assures in a regular manner the transmission of power to long distances. They are applicable in all cases, and a small staff only is necessary. They give a yield of 60 per cent., and their relatively low net price may be made yet lower.

In connection with the prize given by the King of the Belgians on the subject of electricity, the International committee appointed to judge the competition known as the King's Prize (£1,000), held a sitting a few days since under the presidency of M. le Sénateur Montifiore. Among the members of the committee figured, for England, Sir William Thomson, whom, *La Meuse* says, the electricians present justly looked upon as their leader. In addition, the committee was made up as follows:—M. Cornu, professor at the Paris Polytechnic School; M. Roiti, professor at Florence; M. Ponthière, professor at Louvain; and M. Eric Gérard, professor at Liége, who fulfilled the office of secretary-reporter. The Minister of the Interior, M. Devoider, specially went to Rond Chêne, to wish, in the name of the King, welcome to the foreign delegates. After a sitting, which lasted four full hours, the committee terminated its labours by holding its closing sitting in the Montefiore Electro-Technique Institute. The members of the jury visited in turn the laboratories of the Institute, and then separated, after having transmitted the result of their deliberations to the King.

ELECTRICAL TRADES SECTION, LONDON CHAMBER OF COMMERCE AND THE EDINBURGH EXHIBITION.

A MEETING was held on Monday last to discuss the matters given in the agenda published last week. After the correspondent's report had been read, particulars of which will be seen in our "Notes" columns,

Major S. FLOOD PAGE said he had a matter for the discussion of the section, but which was not on the agenda. Some gentlemen have determined to have an International Exhibition of Electrical Engineering, of General Inventions and Industries; there are many of the rules that are extremely stringent, and I think the time has come when members who have been connected with the electrical industries will agree that exhibitions, especially 400 miles away, are expensive, and we get very little indeed out of them, and it is neither fair nor reasonable that gentlemen in Edinburgh who want to make money for the town should call upon us to bear the vast expense in connection with such exhibitions. It is within my knowledge that one firm at one exhibition say they spent £6,000, and they were unable to trace a single direct order to that. Now I am not for a moment suggesting that we should not exhibit, but I am going to propose a resolution that we shall exhibit on our terms and not on theirs. The first thing we are required to do is to pay for space, and in addition to that we have to bear the expense of delivery, working and the cost of installation. We are obliged to insure to make good damage that may arise. Now, I do not consider that fair; I think the rent should be free, in the first place, and that any case of exhibits sent, the Exhibition should take the responsibility. We are asking what is reasonable, and they must take us on our terms or not have a successful Exhibition. I should like to move "That with a view to the electrical industry taking united action with regard to the proposed Electrical Exhibition in Edinburgh, 1890, a committee of ourselves be appointed to consider the conditions on which it may be desirable to take part in the Exhibition, and that a meeting of the entire electrical section be held on November 11th to receive report, and, if they thought advisable, to take action thereupon."

Mr. **SWINBURNE** seconded the resolution, which was unanimously adopted.

The following gentlemen were elected on the proposed committee:—Messrs. Garcke, Siemens, Woodhouse and Rawson, Laing, Wharton and Down, Mather and Platt, Marshall, Major-Gen. Webber, and a representative of the E.P.S. Company.

ELECTRICAL TRADES UNION.

A LARGE meeting was held at the Albion Hall, Moorgate Street, on Saturday night last, in accordance with the notice published in our pages.

The **CHAIRMAN**, who desired his name to be suppressed, referred to a meeting which had been held on October 5th of electrical operatives, when it was decided that a union should be formed. A great number of names had been enrolled; it would be the duty of the meeting to give assistance in the formation of rules, which would be submitted to a public meeting for approval. It was their business to protect themselves, for they did not intend aggression. The mechanical calling of the future, he affirmed, would be connected with electricity in some shape or form, and when they looked at the great improvements made every year it behoved the men to make a "closed circuit," so that the current was always going round. A union would protect the employers, in the fact that the better men would be found to do the work. A rumour had come to his ears that the union was intended for only one or two branches. That was not so; it would embrace every branch, and be placed on the same level as other associations.

The **SECRETARY** then read several encouraging letters from various large centres.

Mr. **ROWLANDS**, M.P. for East Finsbury, who arrived late, then addressed the meeting. He said: As one outside the industry, it is not for me to tell you what to do with regard to things distinctly connected with your own work; what I intend to do is rather to make general remarks of what you can do for yourselves by organisation. I have to congratulate you as a large body of working men in an industry which is of comparatively new growth, and which must in the near future be a much greater industry than it is at the present time. You are again to be congratulated on coming to the conclusion that you think it necessary to organise yourselves. You commenced that movement, not in any combative spirit, not necessarily because you have a grievance here or there, but because you see from experience, and from the illustration of what other bodies of men have done by organisation, that it is an absolute necessity for your own protection. I can say that it is the duty of any large body of men working in a given industry or series of kindred industries, to create an organisation for themselves, where, after subscribing for their mutual protection and assistance they can, in their society, discuss all those questions which have a distinct relation to their own industry, they can thresh out among themselves the position they occupy, and discuss whether there is an opportunity of bettering their position, which, of course, is the ideal we should all have before us. Still, this should not be confined to London alone, but connected with the great number of workers in other large centres, such as London. I hope you will take from me my opinion as to what should be your action in concert with your fellows. I believe that first and foremost you should follow the example of the large industries throughout the country, and form one amalgamated society for the whole country. A great London branch should have the control over all branches, and in each district of London there should be a branch or a series. I am, of course, rather of opinion, that it seems somewhat difficult, if there is anything like the opinion which seems to be expressed in this room, for having one branch to fulfil the requirements of the whole of the metropolis. So far as I am given to understand there are somewhere about 3,000 whom you consider fellow-workers within the metropolis, and I hope sincerely that out of that number the majority will join, and that is what they ought to do. I am afraid you will find—but you must not be disheartened—like other industries, that it takes some time to convert your fellow-workers to the advantages of an organisation like that which you have commenced to create; but, at least, out of such a vast number as 3,000, you ought to have a a very large accession to your ranks, and if you have, then you might form a gigantic branch in London, or else it might be found better, to meet the requirements of London, to have several branches scattered through the metropolis, where the majority were. When you have organised London, your next duty is to assist in amalgamating a society to co-operate with your fellows in the other great centres, so as to form one of those strong and powerful amalgamated societies for your kindred industries throughout the various parts of the country. You then not only have the advantage of having organised a much stronger body of persons, but you also have this other great advantage, that you are able to concentrate your efforts and to accumulate other resources, so that when you require to fall back upon them, you would have something to support you in any undertaking you might think it necessary to go in for. I consider that that is a very great advantage indeed, and I consider it is the model which you should have before you. Of course, you would have to confer, as I understand arrangements are to be made, by delegation with those who have the same opinion as yourselves, and to mutually aid in building a constitution by which you intend to be governed. The question of constitution-making is rather dry work; it is very difficult, and sometimes it is very unenviable work, because in all bodies of men, we are all alike, there is always someone who fancy they could make something a great deal better than that which is decided upon. We cannot, however, all have our own way, and therefore the constitution must be the best representative union which you can get by this system of delegation in conference. Now, having started on the question of your constitution, some of you may want to commence from the beginning; but I think there is no need to do that, there are many organisations already created which have already gone through the preliminary work which you are about to go through, and you may profit a great deal by the work which they have done if you collect the constitutions which they have already created for themselves, you would find the accumulated wisdom they have had to put in their constitution, and you would be able to get as good a set of rules as it is possible to get, and this would save you a very great amount of time and labour. I am not going to discuss what are the exact things which you wish to obtain when you are organised. I can only say this, that there is one thing that you will always gain by organisation, you can always protect that which you have, even supposing you do not want any increase in the shape of remuneration. A trades' organisation is not alone an instrument for trying to get something else, but what is paid weekly toward your union is also a subscription to an assurance society, an assurance society in this, knowing you are organised; if there was an attempt to break down here or there that remuneration which you are already getting, you can at once make a stand to retain it; that is a feature which is sometimes lost sight of by persons who go into these organisations. They forget that it is sometimes as well to pay on purpose to keep what they have, as to try and get something more, when that may not be attainable. There are other questions, say, for instance, you will find labour of an inferior character underpaid, being forced in to take the place of that labour which has previously been used. You can, of course, through your officials, when you are organised, make a representation against that, in fact, there are one hundred and one ways which, when organised, you will see that you are able to protect yourselves, and to do good for yourselves in the industry which it is your lot to have to earn daily bread in There is one thing I am pleased to see, that in forming this you. are going to manage it yourselves. I am a great believer in all societies managing their own affairs. It is the essence of the characteristic of the English people; it is the essence of our municipal life; it is the essence, without going into party questions, of our attempt to get political power for the masses of people, however they may use it. It is that essence of managing your own affairs. I am sure that the one thing you should strike for is from your midst to get the best possible men, who know the whole of the working, to manage your society; because when you can bring these officers out of your midst, and make competition among members to obtain these positions, you are creating a spirit of emulation, and those who may not achieve the office, in trying to do so, are passing through the ordeal which will qualify them for some future time as leaders of their organisation. But, wherever I look at the successful organisations that have taken place in this country, whether in friendly societies or in big trade union, I find they have been managed by the men who required them. It is because they have been managed by those who required them that their success has been attained, and they have met the wants of those who required them. Now, it is therefore with great pleasure, indeed, that if I can be of this little assistance to you in trying to guide you, not in trying to teach you what I do not know with regard to your industry, but in trying, with my best experience, to give some little information of the road you should take, if I can give you, in the same spirit that I am sure you will accept, that little amount of advice I am able to give as one standing aloof from you, but who wishes you to take that road which will lead to success, and which, I am sure, in the future will be a blessing to you who come into the organisation. I am sure that many evils which men complain of to-day can be overcome if they were only organised, at any rate a great many difficulties could be solved, and I am pleased to see the spirit which is abroad at the present time amongst those who hitherto have neglected organisation, that they are wanting, and are going to join, the large organisations which have existed through the country for such a large number of years in connection with some great industries, and which have been such a blessing to those who have become members of them. You are asked possibly to make a temporary sacrifice in the way of subscription, and there are always unfortunately some men who look at this small sacrifice they are called to make as though they were giving something away for the benefit of others. There is not a greater mistake; they are only putting their little with some others little for the benefit of the whole. They are only doing that which has had to be done in the past before anything whatever has been achieved in England. Some may not see so speedy a benefit accruing from joining an organisation—some people want to see the millenium at once—but supposing they do not happen to see it at once they must remember that some of the reforms and some of the advantages—which, perhaps, seem to linger a long while on the road—when they are attained, are the most beneficial, and are the most stable of any advantages that could be obtained by any body of men. Now, I do not intend to occupy your time any longer. You are here for a business meeting; you are here for business purposes, to give your new child another lesson, and I hope the child will be able to walk very successfully. I must congratulate you on a meeting like this on a Saturday evening, when some men are generally drawn away by other attractions. You have taken a wise course in meeting in this hall, where your minds could not be diverted from that business which you have in hand. I can only say in conclusion that any service I may be to you in your proceedings, before you get thoroughly organised, I should be only too pleased to give. I hope that as soon as you get thoroughly organised you will be able to do like other big organisations, walk alone, because you have in yourselves that spirit of organisation, that desire to do good to one another, and that co-operative instinct which can only be developed by organisation, and which means prosperity and benefit to all who heartily and sincerely enter into it.

A vote of thanks was proposed, the speaker considering that the best vote of thanks to Mr. Rowlands was to join the organisation. Cheers were then given for Mr. Rowlands.

Mr. Rowlands, replying, said that if he came to their annual meeting and they told him nine-tenths of the men were in the organisation he should be delighted.

The meeting was a very representative one, and 300 names were given in during the evening as members. Delegates have been elected to meet the Manchester Union. We are requested to ask that all communications be sent to the Secretary, Paul's Head, Finsbury.

NEW PATENTS—1889.

16144. "An improved electric tell-tale clock." H. Hayman. (Communicated by A. Gundersen, New Zealand.) Dated October 14. (*Complete.*)

16148. "A new or improved invisible portable contact for house telegraphs and electric conductors." H. Studte. Dated October 14. (*Complete.*)

16210. "Improvements in electric dry batteries." A. Wolfschmidt and C. Brehm. Dated October 15.

16231. "Improvements in dynamo-electric generators." G. Pfankuche. Dated October 15. (*Complete.*)

16241. "Improvements in secondary or electric storage batteries." H. H. Carpenter. Dated October 15. (*Complete.*)

16275. "Improvements in electrical switches." G. H. Bassano. Dated October 16.

16331. "Improvements in the manufacture of illuminants or light-emitting conductors of electric lamps." J. Clegg. Dated October 16.

16366. "Improvements in electric cables." D. Sinclair and H. F. Jackson. Dated October 17.

16374. "An improved portable electric lamp." A. Serraillier and G. P. Armstrong. Dated October 17. (*Complete.*)

16466. "Improvements in electric meters." C. Nichols. Dated October 18.

16500. "Improvements in and relating to electric regulators or balances." F. V. Maquaire. Dated October 18.

16564. "Improvements in apparatus for winding clocks by electricity." H. H. Lake. (Communicated by F. E. Morgan, United States.) Dated October 19. (*Complete.*)

ABSTRACTS
OF PUBLISHED SPECIFICATIONS, 1888.

12609. "Improvements in or relating to electrical locks." W. P. Thompson. (A communication from abroad by E. Lemonon, of France.) Dated September 1. 8d. Claims:—1. An electric lock bolt having a circuit controlling device consisting of a knob pushed by the door to which the lock is attached, and closing the circuit by bringing into contact two springing strips, the electrical contact of which is insured by a frequent and automatic cleaning, substantially as described. 2. In a lock bolt such as described, the armature providing against remanent magnetism, and carrying a stirrup which releases a lever held under the heel piece of a releasing device, which lever when released allows a head piece to swing round, thus permitting a spring bolt to emerge and the door to open under the pushing force of a knob, thus breaking the circuit, which is only re-established by again closing the door, by which means the said knob is again pressed back, substantially as described, and for the purposes set forth. 3. The improved lock bolt taken as a whole, substantially as described and shown.

12856. "Improved apparatus for converting electrical currents." C. Zipernowsky and M. Deri. Dated September 5. 8d. Claims:—1. An apparatus for converting alternating into continuous electric currents, the combination of a stationary divided iron ring wound with one pair or with several pairs of coils for the alternating currents, so connected that the current in one of each pair has its phase one quarter of a wave length differing from that of the other, a set of coils for induction wound on the ring and connected, as in a Gramme machine, to plates of a stationary commutator, an electro-magnetic armature revolving and carrying suitable pairs of brushes around the commutator, contact rings connected to these brushes and springs pressing on the rings to convey the continuous currents which are induced in the Gramme coils, substantially as herein described. 2. The modified form of apparatus wherein the coils are on a divided iron drum revolving within a stationary electro-magnetic armature, the revolving drum carrying contact rings for the alternating currents, and carrying also a revolving commutator which is rubbed by stationary brushes to convey the induced continuous current, substantially as described. 3. The modified form of apparatus wherein a stationary divided iron drum is surrounded by a stationary iron ring, either the drum or the ring being wound with one pair or with several pairs of coils for the alternating currents, and either the ring or the drum being wound with the coils for induction, having their stationary commutator on which rub suitable pairs of brushes revolving with an iron anchor along with rings pressed on by stationary springs for conveying the induced continuous current. 4. The use of apparatus such as are referred to in the preceding claims for converting continuous into alternating currents by leading the continuous current through brushes and commutator to the continuous coils, providing the anchor with a coil closed on itself, and also with a continuous current coil, and connecting the alternate current pairs of coils so that the current in one of each pair is in a phase differing by one quarter of a wave length from the other, substantially as described.

14963. "Improvements in electric bells and signals and in appliances for use therewith." E. Cox-Walker and A. A. Campbell Swinton. Dated October 18. 11d. The inventors employ for the receiving mechanism of an electric bell or signal an armature which may be of H or similar section wound shuttle-wise with insulated wire or may be of the other forms commonly used in dynamo machines and motors, and is pivoted on an axis so that it can partially rotate between the poles of a permanent or electro-magnet or several such magnets, the said magnet or magnets being preferably fitted with soft iron pole pieces suitably hollowed out so as to leave a cylindrical chamber between them in which the armature moves. 14 claims.

CORRESPONDENCE.

Energy.

My ideas on lightning conductors are already known, having been communicated to the "Inst. Elect. Eng." during the recent discussion on this subject. I have, however, given more attention to the practical, than to the theoretical side of the question; and therefore read the articles appearing from week to week in your columns on "Lightning Conductors," so ably written by Mr. S. Alfred Varley, with much interest and profit. When, however, I caught sight of his article headed "Energy" in last week's Review, my interest was doubled, for, of all others, this is my "hobby." I say I read it with interest, though assuredly not with profit, although it may seem at first glance that where there is a question of "interest," there is also one of "gain." Whither have Mr. Varley's thoughts wandered? He seems to me to have mixed up energy, electricity and matter in such a way as to puzzle most physicists to unravel the mystery he has made. Although he opens his subject with a declaration that all *is* mystery, that mystery is nevertheless entirely of his own making.

That force which Newton discovered in matter—the force of attraction—is the origin of all known forms of energy. That one force can be changed into all the other existant forms. We certainly see it "unlocked in the firegrate" in the form of heat, but it just as certainly does not disappear. It simply acts on the force of attraction or cohesion in the particles of water in the boiler, giving it a thermo-electric form of a repelling nature (like electrics repel each other), and causing the molecules or particles of water to break away from each other. As soon as this force of breaking away becomes perceptible, it is then called mechanical energy. In the same way it may be shown how the mechanical energy affects the force of attraction in the particles of matter in the wire and iron forming the dynamo system, producing the electric current; but in no case does the energy literally disappear. When we *seemingly* lose sight of it, be assured that it is a case of reaction, and that some form of energy having been imparted to some body by the energy in another, that other is affected by the reaction. In paragraph two, comparison is made between energy and electricity. Mr. Varley ought by this time to know that electricity is but a form of energy, and therefore cannot be compared with it, except that the energy be in another form. It is, then, the *forms* of energy which are compared, not energy with its forms.

Again, the statement is made that energy can be added to, or taken from matter. This fact is only partly true, and then even only in a special case. Energy can be given to a body by impelling it against another. This is the only case of which I know; and I am not at all sure that it is true here. The body is moved, but the particles of that body receive no energy whatever. The prevention of further motion changes the energy of the molecules of the moving, and of the resisting body. The original statement, as above, is most absurd. Where inertia exists, there is also latent energy (generally in the form of attractive or cohesive force), and if acted on by energy in some active form, it will itself become active, causing work to be overcome; but this is by no means *adding* energy. It is simply making it more active. The law of "*Actio et Reactio*" seems to have been forgotten. If a body be internally affected by an active force (for instance, giving out heat), that force is but *seemingly* lost when the body cools, and a second one becomes heated. The latent energy of the second has evidently become transformed to heat; but, on the other hand, the energy of the first body *has not been taken away*. It has been changed to a form of attraction, and under its influence the body contracts. Energy then *cannot* be added to, or taken from matter.

In paragraph three, and about six lines down, we are told, that for energy to be available, it must be associated either with matter or electricity. I dare say that from the context, I might guess at what Mr. Varley is driving, but he assuredly does not express it. I have already shown that electricity is but a form of energy. Neither electricity nor any other form of energy can exist independently of matter, nor can one conceive of matter without energy—either latent or active—so that the above statement, of available energy being associated with matter, is self-evident.

The law, then (if it is worth calling one), which we find in the last lines of paragraph three, should now read as follows:—*The more active or useful the energy in a body becomes, the greater will be its effect in influencing the form of energy in another body*. After modifying, this, too, becomes almost an axiom, so that so far Mr. Varley's information does not go for much.

The end of paragraph four, and the entire of five, seem filled with the same curious, though erroneous notion, that energy and electricity are two distinct things. The wonderful part of it all is, that with false data, Mr. Varley has been able to jump at correct conclusions, and on this I sincerely congratulate him.

From paragraph six we receive the startling announcement that a difference exists between electrical motion and matter in motion. As far as I know, electrical motion and matter in motion (under certain conditions) are synonymous. Electrical motion is essentially matter in motion. Energy in the form of electricity gives a certain motion to matter. This motion is perfectly analogous with electrical motion—the two are one and the same thing. I could go on criticising at some length, and in a similar strain, the first half of next page; but it is quite unnecessary to travel twice over the same ground.

In the middle of paragraph three, and in column two of the same page, certain *phenomena* are said to be due to a composition of *laws* or *forces*. Is this statement not rather mixed? How can phenomena be due to laws? Forces act under certain conditions, which for want of a better word, we call laws; but it is the forces which are the cause of phenomena. The word *phænomena* was invented by the Greek Permenides of Megro; and by it he signified *fleeting appearances*, to distinguish it from *noumina* or *known facts or truths*. Now, the fleeting appearance may be caused by one force, while the true effect may be caused by another; but neither the one nor the other is caused by two or more forces; nor is any single force bound by more than one law. Every force has its law, and every force has its separate effect; although we may not at once be able to detect it. I will not longer trespass on your valuable space; but thanking you in advance for the insertion of this letter.

Leonard Joseph.

The London Tramways Company.

In your "Notes" of last week's issue, you state that the above company intends "not only to drive Jarman's cars, but to light houses from its depôt by electricity." As I see from a not very old price list of the Jarman Company that Mr. Jarman is an inventor of dynamos, lamps and accumulators, I am very curious to learn whether these are to be used in the proposed work announced by you. Probably your correspondent and my namesake, Mr. John Willis, can inform me.

Harry Willis.

October 28*th*, 1889.

Lightning Conductors.

I am not surprised that a laudable desire to expose error, combined, possibly, with a keen sense of the ridiculous, should have led you to make merry at my expense, and to somewhat exaggerate, by the way of emphasis, the bad logic at the end of my last contribution.

The blunder perpetrated was the less excusable that the song I have been endeavouring to sing is harmony and continuity in all things, and I ought certainly to have recognised that, as you cannot possibly destroy matter by repeated subdivision, so, also, a difference of potential cannot be altogether annihilated by a process of halving and halving.

The only excuse I can plead is *Nemo mortalium omnibus horis sapit*, especially when he burns the midnight oil. I am sorry to have to confess my last contribution was written during the small hours of the morning. Being far from happy as to what I had written, I called on an eminent scientist who is strong on those points where I am admittedly weak. My friend unfortunately was not in when I called; had he been in the way my bad logic would certainly have been set right in time to prevent its publication.

I may, perhaps, be allowed to state what has been omitted in the leaderette, viz., that the blunder did not escape the Lynx eye of the scientific editor. It was detected by him just before going to press at a period too late even to insert one of those editorial notes which occasionally appear in the Journal, and which are so consolatory to "esteemed correspondents."

I remember my father once saying, sternly, by way of reproof, "Fools learnt by their own experience and wise men learnt by the experience of others." I replied that the knowledge obtained at their own cost by those he had termed fools, I ventured to believe, was more valuable to them than that which was obtained at the cost of others by those he had called wise men.

Be this as it may, the offence I have been guilty of has afforded the occasion for a very interesting scientific discussion between myself and friend, which has been certainly profitable to me, and I think not altogether valueless to him.

S. Alfred Varley.

Electropathic Quackery.

I enclose an advertisement which I have copied from *Bell's Weekly Messenger* of November 11th, 1810. You may perhaps think it sufficiently interesting, on account of its antiquity, for publication.

Gilbert S. Ram.

29th October, 1889.

"*No patent invention has ever been offered to the public of such intrinsic service to mankind as Dr. Cavallo's Electric Girdle, for effectually curing ruptures of every description, debility of the longest continuance, and all weakness, obstructions and relaxations of the whole system, connected with these complaints.* In these, and numerous other cases, Dr. Cavallo has applied his electric girdle with invariable success, during thirty years extensive practice, and has never once known it to fail, even when every other known remedy had been previously tried without effect. So certain and safe is its application adapted to every constitution, that the doctor will forfeit £50 if it produces any disagreeable sensation even in the most delicate infant. Dr. Cavallo and Son (member of the Royal College of Surgeons, &c.) being the only proprietors, it is not to be had of any other person in the United Kingdom. The electric girdle, price £3, may be had, by applying personally, or by letter inclosing £3, from any part of Great Britain, directed to *Dr. Cavallo and Son, No. 28, King Street, Bloomsbury Square, London. N.B.*—Advice every day on all other cases; and all post-paid letters, stating cases from the country, immediately answered. From the rapid demand for this girdle, and the great difficulty in procuring the materials, the price will be raised to £5 after the 1st of January, 1811."

Teachers and Students.

I have been lately very busy, and my attention has only now been attracted to your notice of my address to the Junior Engineering Society. The address was prepared very hurriedly, and I was glad to insert in it bodily some sentences from my previous published utterances on the historical part of my subject. One of these sentences, taken from my introduction to "Electricity in the Service of Man," began: "In that year Varley and others. . . . ." I had previously been speaking of Sir Wm. Thomson, and I hastily interpolated, after the name *Varley*, the words: "who was Thomson's partner." I acknowledge that in this I was very forgetful. Messrs. Cornelius and Samuel A. Varley were the patentees of whom I meant to speak. But I was even more forgetful than this, for I am quite sure that the readers of the ELECTRICAL REVIEW know that the Varleys did not complete their patent in 1866, and that it was presumably for this good reason that Hjorth, in his English patent of 1854, had described with much greater fullness the principle in question.

John Perry.

October 28th, 1889.

Transformer Tests.

My attention has been called by the talented reviewer himself to the review of Dr. Fleming's book on transformers which has been lately appearing in your Journal.

I see that, with his customary relish, he has fallen upon and torn to pieces some tests of a Gaulard and Gibbs transformer given by me. I am sorry to spoil fun, but must really point out that the assumed deduction of $2\frac{1}{2}$ per cent. for loss in iron has no existence in my figures. I merely give the measured quantities and all the elements of the calculation, and your reviewer might have discovered the mistake in Dr. Fleming's book with half the expense of labour that he has devoted to making hay of the tests. Further, how does he know that the lamps were voracious?

I do not give the candle-power, as it happens the lamps were very good ones, and I should be glad to see their like again.

P. Cardew.

October 29th, 1889.

Should It Be So?

One by one the larger so-called supply houses, impelled by the desire of obtaining a double profit, open installation departments of their own and undertake the erection of electric light installations, so that at the present time an electrical contractor (not already a manufacturer) can hardly find a single firm from whom to purchase material who does not at the same time compete with him for the contract.

It is clear that he cannot put in the manufacturer's material and compete with him at the same time, so that each contractor must manufacture his own switches and cut-outs, &c., and so saddle himself with the great detail work manufacture implies.

Surely the supply houses are able to sell enough material without making outlets of their own? In any case, there should be a good opening for a house *entirely* devoted to supplies.

In all other trades the tendency is towards subdivision, and I cannot but think that we are moving in the wrong direction, when every contractor is almost compelled to double his staff and troubles by adding manufacture to his business.

It might be advantageous to hear what both sides have to say upon this subject, and I know that your columns are always open to anything that may tend to the benefit of the electrical industry.

Enquirer.

Accumulators at the Paris Exhibition.

The Commelin-Desmazures accumulator may be seen in the well-known building devoted to the War Department on the Esplanade des Invalides, where 50 little 12 lbs. cells are used to work a six-ton breech-loading gun of the "Canet" type, by the Société des Forges et Chantiers de la Méditerranée, in the carriage of which two motors are concealed.

The gun and carriage, weighing some 10 tons, are instantly moved into any required position by a diminutive lever moving both vertically and horizontally—according to the motion required in the gun.

The battery, arranged in two boxes 30 inches × 18 × 8, holds 200 ampère hours, say a useful discharge of 50 ampères at 35 volts for $3\frac{1}{2}$ hours.

The motors, gearing, and switch, all of which are perfectly protected within the gun-carriage, are the invention of Captain Krebs.

The accumulators were taken to the Exhibition fully charged, and have been only once re-charged since, a heavy discharge for a few seconds only being required to show the working of the gun.

P. Bedford Elwell.

October 28th, 1889.

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MANUFACTURED BY [illegible]

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COTTON AND SILK COVERED WIRE FOR DYNAMO MACHINES, [illegible]

LAURENCE, PARIS & SCOTT, [illegible]

Electrical Engineers & [illegible]

GOTHIC WORKS, NO[illegible]

DYNAMOS AND [illegible]

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OF

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WATERPROOF GARMENTS AND FABRICS:

[illegible]

EBONITE.

Not affected by Vinegar or [illegible] or Acetic Acid.

[illegible]

GUTTA-PERCHA.

Tubing, [illegible], [illegible] &c.

Works: SILVERTOWN, ESSEX, LONDON, E.; PERSAN-BEAUMONT, [illegible]

London Office—106, CANNON STREET, E.C.

Warehouse—100, CANNON STREET, E.C.

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